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ORIGIN OF THE AURIFEROUS REGION of TACUAREMBO,

its analogy & concordance with others on the American Continent

by CLEMENTE BARRIAL POSADA.

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Can the wealth of this region compare with the auriferous districts of "Camacuám," "Casapava," "Goyaz," the region of the "Congo Soco," "Minas-Geraes," and "Matto-Grosso" (Brazil); with the districts of "Gualilan" "San Luis," "La Candelaria," and the region of Córdoba (Argentine Republic); with the districts of "Aconcagua" and "Ipallel"; that of "Atacama" (Chili); those of "Oruro," "Tipuani," and the regions of "Arica" and "Potosi" (Bolivia); with the districts of "Puno" and "Potosi" (Peru); the district of "Merida" (Venezuela); those of "Zamora" "Zaruma" (Ecuador); with the marvellous region of "New Granada," which comprises the districts of "Muzo," "Otro-Mundo," "Veraguas," "Macay," "Santa Rosa," "Medellin," "Córdoba," "Iquira," and "Bocaneme" (Republic of New Granada); with the district of "Iscan" (Costa Rica); with the district of "Sonora," including "Hostimuri" (Mexico); and lastly with the famous region of "California"?

We will again endeavour to show that the region of Tacuarembó is in no way inferior in richness to any of the places referred to. The region of New Granada, which comprises nine districts, and which we may consider as of equal or even more importance than that of California, is less so than that of Matto-Grosso, and this latter is not richer than the region of Tacuarembó. The four regions and the sixteen remaining districts differ from each other but little in richness, although those of Sonora, Merida, and the region of Córdoba might be considered exceptional.

As far back as the beginning of the year 1878 we undertook to establish the Analogy between the auriferous regions of the American Continent, having some years before brought it to the notice of the scientific world, as well as to the notice of the Capital; and the object was to include the region of Tacuarembó, and to this end we presented certain evidences of its richness, so that when compared with those of the above-mentioned regions and districts, exhibited in the International Exhibition at Paris, in the year referred to, the facts might be made apparent and the end we sought obtained. The result was that the Republic of Uruguay achieved another success, as the facts set forth in a pamphlet entitled "A Geological Study of the Auriferous Region of Tacuarembó" (Annex. No. 1) being considered authentic, and the correctness of the principles laid down therein having been established, this pamphlet was awarded a Diploma of Honour. From that moment the financial world no longer hesitated in devoting a part of its capital and attention to the development of the natural wealth abounding in the territory of Uruguay.

In the year 1861 we had the opportunity of studying two volumes, in the pages of which were traced certain indelible characters of the most remote ages: in the first, "The Pyrenees" (15th System of Upheaval), more recent those of the second (20th System of Mountains), "The Principal Alps," which not long ago (speaking in the sense of Geological Chronology) had raised their leaflets from the depths of the sea, and their chapters—the igneous rocks—from the centre of the earth, causing them to tower to the very clouds.

The principal Alps, which incontestably prove a fresh upheaval, that at the close of the Cenozoic period pushed back the solid crust of the globe, and thus formed a way along the earth towards America, interrupted only for a short distance at Behring's Straits.

Henceforth it was left to us to submit this novelty to proof, and without forgetting the Known, to initiate ourselves into a retrospect, forcing our mind into association with the ossaries of the existences shipwrecked in the world in which they lived, and to decipher in the evidences of wondrous cataclysms the alterations and changes of System in the established order.

On the other hand we observe that in the course of immeasurable ages in which these events had taken place, other unparalleled agencies change the face of our planet. There are twenty systems of mountains which change it entirely and produce distinct climates, but allow of the survival of organic beings, which then blending into one family with the newer creations, at length by their existence imprint another page in the process of geological chronology—existences now brought to light owing to the powerful energies which impelled the formation of the mountain summits from the depths of the sea, where their crests are marked out by joints uniting open fissures, which in the form of lines, more or less serpentine, establish a correlation between the two hemispheres, and linked to one another, constitute the most complete evidence of the arterial and veinous system of the *saxeus-igneus* (igneous rocks) in its origin, and among them QUARTZ, which enfolds the world to the depth of many leagues. Other rocks of different character preceded and followed the former, and like them, in the form of pillars embedded throughout the earth, have their bases resting at unknown depths.

We ought some day to make use of the knowledge acquired, so as to recognise the identity of origin in distant structures, and not to consider as being the same, that which constitutes "Gabbro" and that which forms "Chlorite" in their respective beds; but we should recognise the identity of the black diamond of Africa with the white one of Brazil, whatever may be the purity with which they represent *Carbon*; and in the same way the relationship of the *helecho* (fern-filix) of the Alps with that of the Andes; that of the *trilobite*, an American fossil, with that of Europe; likewise the vertical plane of auriferous-silicic anhydride-acid, which cleaves the strata of the earth, more or less at right angles, at the Cape of Good Hope, as we noticed in 1864; also in Brazil in 1863; in 1864 at "Gualilan," "Merida," "Nueva Granada," and in other districts, afterwards in California, and lastly at Tacuarembó in 1866; and in 1868 at Candelaria (Córdova). Yes, at Córdova; to contemplate, face to face, the scattered remains of inorganic existences, the progenitors of the geological world, which compelled us to describe their condition and record their origin, before serving as the foundation of the chain of the Andes (21st System of Mountains) in the following manner:—

The Orographic Hills, which, as one ascends, grow less, but are much more defined, run, in an average direction, from N.N.W. to S.S.E. more or less parallel to each other: all of them are petrographic, even in the valleys and on the plains, where without proceeding from the mountains, one beholds masses of rock forming irregular series, blocks of stone, fragments and large rocks, heaped up as though castellated, adopting fantastic shapes, and stone clusters at short intervals; all of which call to mind the erratic glacial deposits. For, although they differ from the former by the absence of symmetry, gradation, and alignment, etc., and because the materials belong to the locality, on the other hand the masses of rock and larger rocks are of circular shape, and resemble them through the effect of the unequal composition of the elements of which they are composed, which are silica, feldspar and mica.

Remains of the Rocky Slopes, consisting of ex-granitic porphyroid Gneiss, which was of compact, hard and massive texture, lie in alternate layers, and form deposits from the great landslips, intercalated with more modern remains. Masses of mixed rubbish now rest on the solid and still virgin Gneiss (Specimen No. 1), which crops up in acclivities formed on the land of these valleys and their slopes, at the surface of the superimposed vegetable matter which in some parts has eroded, and in others has been rent asunder.

But though this Gneiss is to be met with in the valleys and the plains, it is also found upheaved and stratified by igneous rocks, such as Compact-pyroxene-micaceous Phonolite, Diorite, Common Serpentine, Lapis Ollaris (Specimen No. 2), Quartz (Specimen No. 3), and Amphibole, the former being present in various veins and dykes, as well as the Lapis Ollaris and Steatite Serpentine (Specimen No. 4), which are also found in dykes and conical hillocks of small size, more or less circular in shape, and at a distance from each other; which by their direction from E. to W. show the cause of the stratification of the Gneiss in the valleys, some of it having a granite-like appearance (Specimen No. 5.), but not of that of the higher orographic reliefs, which are due to the cropping forth of the rock from the inner part, which we are about to refer to. Veins and slender seams of common quartz likewise containing Feldspar and Amphibole, with Hornblend occasionally and also Tourmaline (Specimen No. 6), and also with Crystals of Beryl in places; with leaflets of Mica in little groups, scattered about, which contain quartz in certain fixed localities; as also Argentiferous Lead (Specimen No. 7), Carbonate of Zinc (Specimen No. 8), Carbonate of Copper, Gold and Silver (Specimen No. 9), are met with in the above-mentioned arteries of Silicic-Anhydride-Acid over a district of 190 square leagues, intersected by veins of the same rock intermixed with Gold (Specimen No. 10) in the form of nodules, fibres, arborescences and groupings, filling up hollows, and in leaflets in combination with Tellurium, Silver, Traces of Carbonate of Copper, Sulphurated copperous Pyrite, with Pyrites of Sulphurated and Oxidised Iron. A district which represents approximately an area of 6,700 square kilometres well wooded and intersected by streams.

Thus it is that the arteries or main seams of the rocks referred to crop out intermingled in the vicinity of their kindred originals, the Lapis, Ollaris, Serpentine, &c. But the other, Silicic-Anhydride-Acid (Specimen No. 11), formed into veins or seams, extends over the plains, and consequently produces the hillocks, and marks out the hills, forms the strikes, and then in succession inclining to the Orographic system, the said veins or seams prove that they forcibly upheaved the soil to 1,000 metres above the level of these valleys, and created the peaks of "The Giants" as well as the summit of the Cordillera of Saint Louis, endowing it with a majestic area of 90 kilometres in width by 2,000 in length, running to the N.N.W., whereby was reared, for all time, this chain of the 21st range of mountains, "The Andes."

Silicic-Anhydride-Acid (eruptive quartz), structured into veins lodes and dykes, is in texture a compact mass, foliated in parts, and as it were showing a square base when on the surface appears one of its prisms, in others crystallized and in straight prisms with an hexagonal base. In this chain the said quartz is of a colourless appearance, or of a milky or alabaster white; it shows itself as having been the cause of the upheaval, as well as of that of the lateral mountains to which it imparts a graphic physiognomy like the thermat-skeleton rocks, and makes its way with increasing continuity of its veins until it appears at last on the summits of the heights, which it follows along their entire length, and gives them their sharp and elongated formation like a dorsal fin, with very marked escarpments, presenting here and there also small plains, and in other parts steep declivities.

II.

We have thus given the physiography, although summarised, of the superficial lithostrology of the auriferous region of Córdoba, and have explained that there are intermixed in the “dermat-skeleton-saxeus” a series of veins of other distinct rocks of igneous origin, among which are “Piroxene,” “Prophiroid Trachyte,” “Dolorite,” with other varieties of “Basalt,” which are contiguous to others of still more recent eruption, such as “Iefrine,” “tobas-lavicas,” ashes, &c., which proceed from the eruptive furnaces which appear to be at present quiescent in these regions.

But the whole of these rocks show that the “incandescent mass” in the interior of the globe has been, and is still, in active operation, exerting pressure against the solid crust, which from time to time it has succeeded in rending, at the same moment filling up the said fissures with a portion of its thick fluid mass, and thus giving birth to tifons, dykes, lodes, veins and seams, to which these owe their origin, rather than to hydro-thermal action.

Having portrayed in themselves the “micaceous and steatite” formations to which we have referred, and pointed them out as the necessary representatives of the Azoic period in its later and preceding epochs, we pass on to its immediate successor, which is the lower bed of the “Silurian,” the first-born of the “Palæozoic” period, which manifests itself in patches in this as well as in the other auriferous regions and districts referred to; but neither the former nor the latter are either more recent or older than the strata in which they lie, and which represent a period of not less than four thousand centuries of growth. We must bear in mind that in all the centres or strata already alluded to, the igneous element has acted from the interior, upheaving and stratifying them, whilst externally they have undergone modification, and the said substances have been decomposed by atmospheric elements—that the said regions and districts differ but little in their physiognomy and aspect; and the same identity is observed as regards their respective richness when compared, although we will point out that in those of Matto-Grosso, Camacuám, Tacuarembó, Guallilán and Nueve Granada, the carbon is met with in the form of the "diamond," down to that in which fossil coal intervened. Therefore it is that when describing the region of "Córdova," the object has been kept in view of giving an idea of what it is, since it is the region which presents the most peculiarities in its stratification, downfalls of débris of the mountains, and in its varied orography.

The connection of Matto-Grosso, Aconcagua and Ipallel, as also that of Caracas with a calcareous grotto adorned with stalagmites and stalactites, upon the right bank of the river Guárico, whence one can hear the noise of the waters of the river, represent the chemical action (formation of the stalactites and stalagmites) as giving new life to decayed nature; near there are some thermal springs, and among them one with "Potash" in solution, which imitates the work of the "Geysers" at Mérida (Venezuela), in which country, as in New Granada, these perpetual creations sparkle, whilst the organics, *zoological* and *vegetable,* belonging to all climates are brought together there, and afford the spectacle of hues that charm the eye, alternating with the virgin forests which are more fascinating than in Matto-Grosso and at the missions in the Argentine Republic, where one does see, as in Aconcagua, Ecuador, Venezuela and New Granada, the contrast of colour, mingled with the perfumes of the purest vegetable life, and the white of the eternal snows of the mountain tops. No doubt the descriptions of these countries would seem mutually more agreeable to the inspiration both of him who describes and explains them, and of him who is pleased to read or listen to them, but we should then pay less attention to practical and applied science than to the theoretic and speculative, and this would be going astray from the object of this memorandum, devoted wholly to industry.

And so much is this the case, that we thought it our duty to refer to "Córdoba" and "Tacuarembó," and to enter into particulars as to these countries; and if, for a moment, we put these on one side in order to treat of them as a whole, we shall very soon return to them. Meanwhile we must admit that it is impossible to speak of effects without knowing the causes, nor of the country in which we live, without knowing anything of the soil we tread upon.

Therefore let us consider it in its entirety, and we shall see that, in conjunction with Palæontology, our mind will establish its alliance with Ge-lithognomy, by which we shall be able to interpret nature in its inert as well as in its organised state; to find our way without any other guide into all georographic destinies; and to ascertain that, with the exception of a short span, it runs over the circumference of the globe, and at the least the 9,000 kilometres or more of the course marked out by the "Systems of the Mountains of the Andes"; to consider this as so small that it does not exceed what is in itself; a sign accentuated in character of a minimum line on the volume of cosmo-geology; an indubitable proof of the accomplished design of the Almighty. Yes, we shall be led to recognise that the "Andes" are but a delicate plait adorning the face of our planet, which the power of mathematics places in our hands to be measured, as we do measure it, examine and prove it, without more difficulty than we should have with an orange; to penetrate into it by chemistry, and to acquire the knowledge of its composition, of what it is, and what is its value. The mind will make use of these imponderable ways of light, and with them penetrate also into the composition of the other worlds in space. And if this were not sufficient it would take council with physics and geology, and would succeed, no doubt, in striking the summits of the Infinite as well as the foundations of the Bygone (Retrospective); that is to say, into the commencement of the Ages, at the birth of the systems or planetary creations, and take in, at a glance, the route which will be followed in eternity by these puissant dynasties of worlds which they actually trace in passing the orbits in space, wherein one can scarcely discern that which our own little dwelling place projects around the sun.

What were we in that pre-cited age, the dawn of the Geological eras, before they began to reckon the 400,000 years already mentioned? Were we already in existence, speaking in a physical sense? No, and not even were the rocks formed which we have enumerated, represented by Carbon, Silica, Sulphur, Sodium, Lime, Iron, Manganese, Magnesia, Alumina, nor those which represent the compounds of the bodies mentioned, with Chlorine, or with Hydrogen, Oxygen, Phosphorus, Fluor, Azote, and others which afterwards produced the simple silicates or compounds of Alumina or Potash, of Alumina and Sodium, of Alumina and Magnesia, etc., which form the basis of the greater part of the ancient rocks.

A large quantity of Carbon must then have existed mixed with other gases outside the Earth, until the moment when, meeting with Oxygen, they combined by affinity and formed Carbonic Acid, which then seized upon the metallic bodies of the surface. But the inner mass of the globe continued to give forth, afterwards and successively, gaseous elements, among which Carbon, partly free and combined also with hydrogen, probably remained at the lower part of the atmosphere, until in consequence of the low temperature which in course of time the surface gave forth, vegetable life made its appearance on the earth which (the Flora) by absorbing it gradually and slowly, as it developed through the nutrition it received from the atmosphere, at length acquired that state of purity which by reason thereof permitted the appearance of zoological existences. And even if there were no other ground for forming this opinion than that of the composition of the fossil carbons, we think that this fact by itself is sufficient, and shows without doubt that vegetation purified the atmosphere of its Carbon; for the

"Diamond" or Carbon No. 1, which represents primitive vegetable life, is composed of pure Carbon; it is followed in succession by "Graphite," or Carbon No. 2, representing the second Flora, which contains in its composition as much as 96 per cent. of Carbon. In order of descent from the primeval period, follows "Anthracite" or Coal No. 3, which contains from 85 to 90 percent. of Carbon; next comes Coal, or Carbon No. 4. in which Carbon is represented by an average of 60 per cent.; next comes Lignite or Carbon No. 5, which is more recent, and yet contains from 40 to 60 per cent. of Carbon. "Estipite" and "Dusodila" are varieties of Lignite, if they are not placed in the category of skeleton of Coal; the Lignite is followed by "Peat" or Carbon No. 6, which is the most modern of all; for even in our own times its formation goes on in the vicinity of the coasts or the mouths of great rivers, at their eddies and deltas where their detritus is deposited; on the plateaus, at the level of the eternal snows, as occurs in the Andes; and lastly, in the paludian sites in low-lying regions, as the result of the annual destruction of the herbaceous growths of the locality, and of the accumulation in the deltas of arboraceous refuse or remains. Taking the average of six analyses of different and remote localities, Peat contains in its composition 38 per cent. of Carbon; and, in short, Carbon enters into actual vegetation as it does in animal economy. This element, in conjunction with "Oxygen" and "Hydrogen," from the Cosmic period, mutually and respectively combined with "Iron," with "Calcium," and "Manganese" at the beginning of the geologic times, and formed in part the "*sparry ironstone,*" etc., as is seen in the said rock, as well as in its other varieties," "Junckerite" and "Tomaite," to the proportion of 38 per cent. of Carbonic Acid in the former, and a smaller quantity in the latter. The deposits of this iron in the primordial gneissic soils, and even in the "Permic" itself, is an incontrovertable proof that it owes its origin to the action of primitive terrestrial chemistry. And the analogous deposits of slaty and metamorphic calcia proper to primordial crystalline soils, may no less satisfactorily explain that, in combination with each other, "Carbon," "Hydrogen," "Calmium," "Oxygen," "Manganese" and "Silica" have given rise to the formation of the said calcareous rocks, long before the appearance of the primordial marine fauna, the remains of which are not present in the above rocks, making it evident that nature formed them by first intent, and that they are not due to the detrita of the crustacians, which maybe were not yet in existence.

"Chlorine" and "Oxygen," which in quantity exceeded all the other gasecus elements of the surface, fixed on certain and determined metallic elementary bodies for which they had great affinity, such as "Silica" (which in the proportion of 85 per cent. was represented in the composition of the world), "Alumina," "Sodium," "Potash," "Magnesia," "Calcium," and others, which, on a more or less graduated scale as to quantity, along with "Silica," already at that period formed the outer or terrestrial solid crust in rudimentary consolidation; but "Chlorine" in particular, at an earlier epoch and without the intervention of "Oxygen," must have allied itself with the metallic elements mentioned, by reason of its greater affinity with them than the latter, and formed various chlorides, until, when attracted by "Oxygen," it forsook them to combine with "Hydrogen," which, favoured by the lowering of the temperature, united itself with the "Oxygen" in suitable proportions, and formed water in a vaporous state, which then brought about the blending of the "Chlorine" and the "Hydrogen" in the necessary proportions and in given parts, and formed "Chlorhydric Acid," which originated the liberation of a quantity of "Oxygen" through the decomposition of the water by the "Chlorine," which, combining with the bodies the latter abandoned, for those with which it had greater affinity, originated and formed "Silicic Acid," and at the same time various oxides, particularly of "Potassium" and of "Magnesia," whence resulted through these chemical reactions, and perhaps through others which are unknown to us, the setting up of the primary oxidation of the solid crust of the globe, as also is proved by portions of the primordial rocks, represented by simple or compound silicates of "Alumina" and "Potash," "Alumina" and "Sodium," "Alumina" and "Magnesia," and oxidation which in binding the bodies together, characterised a superficial skin, daily becoming more concrete, and which powerfully assisted the consolidation of the solid crust, a fact which is shown or rather proved by the abundance of oxides in the primordial remains, in which the Chlorides and Chlorurets are wanting, which explains that the formation of water immediately followed by the intervention of "Sodium," which only then found itself in a free state in this colossal chemical laboratory, and in which the "Sodium" precipitating itself on the water, decomposed it to combine with the "Oxygen" and form "Sodium" or "Sodic Oxide," which immediately seized on the metallic bodies, from which it was afterwards freed by the presence of "Chlorhydric Acid," from which the "Chlorine" being liberated simultaneously with the "Sodium" from the metals, both elements combined and gave birth to "Salt" or "Chloride of Sodium," at the same time the "Hydrogen" being liberated from the "Chlorine," and the "Oxygen" from the "Sodium," these two elements came together and re-combined and again formed water, which, owing to the lowering of the temperature on the surface of the planet, soon assumed a liquid state and precipitated itself over the Earth in diluvial torrents, resting at length on its surface and beginning to form the Seas, in which the "Chloride of Sodium" is intermixed and amalgamated, thus endowing the waters with the saline properties as an indispensable condition to enable them to keep together without transformation, and in order that, without delay, numerous existences might find their habitation therein.

III.

Azote.—*Azote* is not found as forming part of the primitive rocks already referred to, although prior to their existence it played a very important part on the surface of the planet. Indeed, from the moment of its appearance as a natural body, it established itself on its outer surface simultaneously with other elements, "Hydrogen," "Oxygen," "Electricity," &c., producing reactions more or less quiet, *inter se*, until the planet commencing to describe its circuit round the Sun, these fluid gaseous elements receiving the impulse of motion were thrown together, some were thrown against their refractories and combined together through the affinity of some among them, such as Azote with Oxygen, which produced "Air." But Azote being more abundant, lighter, more sensitive and subtil than Oxygen, circulated with incomparable rapidity through the atmosphere, and became united to other kindred volumes which were distributed therein, intermixed with other elements. Being thereby increased in volume and with augmented forces, it soon cast off the excess of Oxygen it contained within it; but only a minimum portion (approximately one-fifth of its volume or of that which the said Azote represented), what was indispensable for the formation of the Air, which from that moment was constituted in the proportion of 79·10 per cent. of Azote, and 20·90 per cent. of Oxygen, as the just proportion and exact formation to enable the Air in perpetuity to circulate in accordance with the oscillatory and to-and-fro motion which the world had then, and even for long afterwards, until a second motion followed—a rotatory one—and the secondary movements consequent thereon. From this it resulted that the Air not only became developed and considerably increased, but that henceforth it was able to circulate majestically through the atmosphere, to move it and rend in all directions its formidable thickness of vapours, gases and electricity in shapeless mass, forming a veil which everywhere overhung and darkened the world. In this condition, the Air operating in relation to the activity of the centripetal and centrifugal forces, and aided by the cold of space, caused the elements to whirl about and react upon each other (being driven thereto by the retraction produced by the cold which surrounded them, and contributed at the same time to make them change their form), condensing them. Thus it was that some of them in combination, and others acting by themselves, had a tendency to precipitate themselves upon the earth and to lay there, in which they did not then succeed on account of the albant condition it yet presented.

They were consequently repulsed, and again returned in the form of vapour to the atmosphere; nevertheless, with the aid of the law of attraction, the air and the cold, with their unceasing efforts to make these vapourous substances liquefy and solidify, at length in the course of time, succeeded, after having cast them an infinite number of times back on the earth, in making them rest there and remain for a longer or shorter period. The result was, that the waters and the other elements of the Atmosphere, in contact with the metallic bodies of the surface, formed, through the operation of the still high temperature, a new chemical laboratory, and with dynamo-mechanical forces, so powerful, so tenacious, and so persistent in the sense of bringing about the union of the materials such as Silica, Aluminium, and Fluorspar; Silica, Aluminium, Manganese, and Water; Silica, Aluminium, and Potash; Oxygen and Iron; Silica, Aluminium, Oxygen, Iron and Manganese; Oxygen, Aluminium, and Calcium; and various other Silicates, etc., that the consolidation of the outer crust, till then in embryo, became an accomplished fact, from which at once sprang the formation of the "Primary Rocks," which of a uniform and compact shape constituted the above-mentioned Solid Crust, of a thoroughly flexible character, so as to permit of its resisting the shocks and the enormous tension which arose immediately from the vast ocean of Igneous Electric Liquid, Gaseous and Electro-Dynamic substances which were now confined, and in consequence at open and perpetual war with the said crust in obedience to the natural laws of expansion of its composition. But having succeeded many times in bursting through, or rather rending it in parts, and obtaining relief by the said fissures, it has, nevertheless, continued immutable up to the present time, when by its incomparable strength and relative power, it may be said that these forces are powerless to imperil it.

At all events, the air continued its work of convulsively mobilising the colossal nebulæ which threw a dense veil of darkness over the whole planet, permitting the light of the sun to penetrate at intervals to its surface, as an infallible prognostic that in future it would shine upon the earth; that is to say, when by the continued lowering of the temperature, the surface should present suitable conditions for the appearance upon it of vegetable life, thus accomplishing the end for which it was designed, and absorbing the Carbonic Acid Gas with which the atmosphere was saturated.

This was the only means which would allow of the appearance of "Zoologic" life later on, without danger of asphyxiation, even in presenting itself, in the first instance, in the waters of the sea, as in fact occurred, anticipating by many centuries "terrestrial life," or aërial respiration, or of "Azote" and "Oxygen" combined, which inhaled in the form of air by its individuals, should afterwards pass along with the bodies of defunct generations to their graves, thus fulfilling two most important purposes: that of azotising the soil, and at the same time forming fossil subterraneous worlds, which, starting from the aquatic or primordials, consisting of the "Salurian" or "Laurentius" base of the

"Palæozoic" period, should afterwards follow in succession by superposition one upon another until the advent of "Man," for whom they presented not only the Earth ready prepared, so as to be capable of furnishing him with subsistence, but also in these selfsame fossils, the later writings of the sublime history of the Creation—true rays of light which have guided him to penetrate through the generations and bygone ages, and to discover in its inmost recesses even the primitive cinerary urns, at a depth of 57,000 metres, where they ought to be, and where a few are found, serving as a stepping-stone to the tombs of more recent lineages, and over which other worlds,—forming as it were, superimposed pavements which form the base of pyramids and empires of skeletons converted into stone,—come down to our times, commemorating chronologically the respective dates when they were torn from life by the fury of cataclysms.

Let us proceed to give an account of other combined elements.

IV.

SULPHUR.—*Sulphur* must have been stored in the interior of the Globe, as seems to be proved by its presence in minerals, which increases in proportion to the depth, and by its special affinity with metals of igneous origin. In no other way can we explain how it is that, being naturally so volatile, it has been able to maintain itself on the surface, from the very first, in a free state. How can one otherwise conceive, in the then state of ignition of the whole planet, the surface of which was occupied by the very lightest gaseous elements, that Sulphur was not to be found among them, which is of so volatile a nature, when even now-a-days we see it adhere tenaciously to electricity, which seems to be its necessary attendant, following in all its evolutions, and even at the moment when it hurls itself on the earth in the form of the lightning's flash or thunderbolt?

It is, then, beyond doubt that "Sulphur" in a gaseous state, during the primary geological ages also had its place on the surface of the planet. The igneous substances which are cast up by volcanoes appear to be saturated with Sulphur; how then can it be imagined that the earth would not give it forth when in a state of ignition, and that having now so great an affinity with electricity, it should not have the same affinity then, when the latter was agitated with universal convulsion in the external atmosphere and the interior of the Globe?

This seems to prove itself. And yet Sulphur must, also by affinity, have combined with Oxygen, and formed Sulphuric Acid, which in presence of vapour from the water turned to Hydrosulphuric Acid.

In like manner it combined with Carbon, for which it has not the slightest affinity, and in both cases there would have been no reason why, if not all, at least certain plants, should not have absorbed it as they all did with the Carbonic Acid, and all the more so since Carbon and Sulphur are not refractory. But the fact that Sulphur is to be found in coals, and especially in those transformed and converted into anthracite by the posterior action of igneous substances, seems to prove that it really did exist primarily, not only in the bowels of the Globe, but likewise on its surface, judging by the Pyrites in very ancient soils. Nevertheless its appearance on the surface must have taken place in posterior times, as is proved by the alkaline rocks, and some of Iron, especially the Pyrite by its abundance, next the Copper Pyrite, the Blends, Antimony, Galena, Magnesia, Lime, &c.

FLUOR.—*Fluor,* both in the interior as well as at the surface of the earth, has from the beginning played an important part, and it is recognised either by itself or combined with Hydrogen; and even as a quintuple compound with "Bromine," "Iodine" and "Chlorine," by the perfect relationship existing between them and its various combinations and reactions, sometimes independent and sometimes reciprocal, but always simultaneous, powerfully assisted the formation of the primary rocks, which afterwards becoming free, contributed to form other mineral bodies, such as "Mica," "Topaz," some "Pegmatites" and "Limestones," "Magnesia," "Lime," &c., leaving to the Primary Rocks a very notable porous structure.

V.

PHOSPHORUS.—*Phosphorus,* in alliance with Electricity, Sulphur and Carbon, and combined also with "Oxygen," thus forming Phosphoric Acid, and united with various minerals, existed from the first in the interior, at the surface and sphere of attraction of the Globe, for not only is it recognised in atmospheric electricity and in animals, but it also forms part, although in almost inappreciable quantity, of some ancient crystalline rocks—quartz, the diamond, &c., and in notable proportions in the following bodies: "Edwardsite," "Erémite," "Criptolite," of the metal "Cerium" in Gneissic soils; in "Vivianite," "Dufrenite," "Kraurite" and "Farmacosiderite" of the metal "Iron" in ancient soils; in the "Phosphate" of the metal "Calcium"; in the Silurian earths up to the tertiary; and in "Magnesia" in the species "Tenotima," of the genus "Itria."

VI.

Such were our precedents with reference to the connections with the Universal Creation at the time of our arrival in 1886 in the department of Tacuarembó, for the purpose of seeking in this "Azotic," "Palæozoic," and "Cenozoic" nature, the story of its vast and most ancient history, as well as the revelation of the gifts with which Providence had endowed it. We discovered the indications of her treasures stored up in the heart of a sanctuary where certain lineaments are majestically pourtrayed, which we scrupulously copied (see the GEOLOGICAL PLAN of the part of the said region which accompanies the present Concordance under the title of Annexe No. 2.)—indelible tokens characterised by salient profiles, which, born in the heart of the world at the very commencement of the "Palæozoic" period, lay about on this soil exposed to the effect of the Sun and the rigour of other atmospheric elements, without diminishing its existence, still full of ampura.

We refer to a rock which, properly designated, is the Silicic-Anhydrous-Acid, a portion of which gave indications of the presence of Gold and other metals (samples marked with the numbers 12, 12a, 12b, 12c.), structured with veins or arteries, that is to say, in dikes, seams, veins, and threads of importance, though unequal in lengths and powers, the texture evidently adelogene formed a contrast with the fanerogene rocks which constituted its surroundings, the "Graphic Pegmatite" (samples No. 13 and 13a), a few Serpentine rocks more or less labradorite, "Gneiss," "Chlorite" (sample No. 14.), coloured with Carbonate of Copper, "Dolomite," "Diorite," "Micaceous-amphibole," (sample No. 15), "Ferrugineous breccias," "Silicic pudding-stones," "Tabular asperon," or in layers, &c., not far from the "Porphiritic trachyte," and others of the same family more recently erupted, which constituted their interesting lineage.

But what was the cause of the upheaval and stratification, in part concordant and in others discordant, of the materials of the Neptunian series? Was it perchance the isolated efforts of the rocks of the eruptive or igneous series, first those of the former, and afterwards those of the latter, successively, in competition, or protected by the action of the second, all working in a district which contains approximately some 10,625 square kilometres, or a longitudinal extent of 9,000 kilometres of a system of mountains that begins at the 55° of N. latitude, and succeeding, with their impulsive manifestations, in upheaving the soil in the country of Uruguay, raising up, as well as other Departments, that of Tacuarembó, wherein were thrown up prodigious riches? We who were making researches into its origin, and accumulating data, were inclined to the latter supposition. With the certainty which nature itself guaranteed to us, we ventured in the year 1869 and again in 1878 to announce to the scientific world, and the Capital, through a pamphlet entitled "*Geological Study of the Auriferous Region of Tacuarembó* (Annexe No. 1), that the same orography, the source of the riches produced in California, Matto-Grosso, and other regions, was that which had with like prodigality endowed that of Tacuarembó. We venture to transcribe Chapters I and II of that account, which are as follows :—

CHAPTER I.

The mineralogical axis of this region is formed by the Cordillera of Santa Anna, which trends in the direction E. 32° 30′ 8″, and to the N.N.E. part of Cordillera of "Haedo." Its extent within the Republic is 128 kilometres, the same which on that side, form the boundary of its frontier with Brazil, to which country the remainder belongs. Its average height is 490 metres above the level of the sea, and its slopes run towards the Department of Tacuarembó in this Republic on the one side, and towards Brazil on the other.

These chains of mountains extend in succession, and form the "Nexo" or Knot of Santa Anna, which is situate at 30° 52′ 18″ S. latitude, and 49° 31′ 2″ W. longitude from the Meridian of San Fernando.

CHAPTER II.

Geographic connection of the mineralogical Axis, its origin and extent.

The Cordillera of Santa Anna is a ramification of the Mountain System of the Andes, which stretches from the Straits of Magellan, and extends to beyond 50° of N. latitude. The Sub-system of Mountains of Uruguay leaves the Cordillera of the Andes to the West of Chuquisaca, and from there begins to form great inflections. This *sub-system*, which we shall henceforth call the "Gran Ramal," divides the waters to the S. and N. of the rivers; to the North, Madeira, Tapajoz and Xingii, affluents of the Amazon, the rivers Araguay and Tocantius, affluents, the former of the second, and the latter of the Rio de Pará.

The Gran Ramal forms the heights of Matto-Grosso, it runs to the E.S.E., and gives waters opposite to the rivers of South Paraguay and Panama, of which the former falls into the latter in the Province of Corrientes, in the Argentine Republic, and then at latitude 34° the river Uruguay joins the Panama, and forms the *Estuary of La Plata,* which falls into the Atlantic Ocean to the South; and the Amazon and the Pará to the North.

The *Gran Ramal* reaches to the Pyrenees mountains of Brazil to the E. of the town of Boa de Goyaz, where it divides into two parts; one sub-ramal trends to the N.N.E., and reaches as far as the 3° of south latitude at Paranahyba, and pours its waters into the river Piantry, at Jaguaribé and San Francisco, which have their mouths in the Atlantic.

From the Pyrenean Mountains, it turns towards the S.S.E., and supplies the sources of the river San Francisco, passes to the W. of the town of Rio Janeiro, and pour its waters into the river Paranahyba, and then into the river Iguapé; runs through the Provinces of San Paulo, Paranaguá, and Santa Catharina, supplies water to the river Uruguay crosses, the Province of the Rio Grande do Sul, gives its opposite waters to the rivers Tacuari, Olimár, Cebollati, Yi, and Santa Lucia, and reaches up to the City of Monte Video.

Within the Republic it divides into four chains or sub-divisions, which are known as the Cordilleras *Grande, Haedo, Minas* and *Santa Anna.*

This great branch in its extension upheaved and stratified the lands of various geological periods, and in the districts of "Yaguari," "Corrales" and "Cuñapirú" brought to light the materials of the Silurian group (lower bed).

Well, then, the said bodies with others of distinct geological periods of more recent date, formed the basis of the said *Auriferous Region of Tacuarembó,* and cause the Physiography of its mineral species.

It must be observed that the genera, species and varieties which we give below, are those which we have discovered up to the present time in the region referred to:

GENERA.

Carbon—1st species: "Diamond."
  2nd species: "Graphite," colouring aluminous bodies.

Silica—1st species: "Silicic-Anhydrous-Acid" (hialin quartz), represented by the varieties "Amethyst" and others.
  2nd sub-species: (common quartz of eruptive origin), structured in veins, *i.e.,* in dykes, seams and threads.
  3rd sub-species: "Agate Quartz," (2nd, 5th and 7th varieties), "Cacholong," (blood coloured), "Chalcedonius" and "Heliotrope."
  6th sub-species: 8th variety, "Ligneous Opal"; 9th, "Lithogene."

Sulphur—2nd species: represented by Hydrate Sulphate of Lime (Gypsum), in the constituents of Copper and Iron "Pyrites;" by Silver in Argentiferous Galena; by Lead among the Tefrinic and Lavic substances; also in those of the Carboniferous Earths.

Arsenic—Is represented in the quartz veins, intermixed with Argentiferous Gold and Lead.
Sodium—1st species: Chloride of Sodium.
Lime—1st species: Calcareous Spar.
2nd species: "Silicious Marble," pyritous non lacustrous.
3rd species: "Dolomite" (magnesian lime).
5th species: "Concreted Plaster" (Gypsum), "Selenite Spath."
Iron—2nd species: "Markasite," "Martial Pyrite," "Sulphur Iron."
3rd species: "Esperkiss," "Radiated Pyrite."
3rd species: *Variety*, "Crucite."
4th species: "Lebrekisa," "Magnetic Pyrite."
7th species: "Magnes lapis," "Magnetic Oxide of Iron," "Black Oxide of Iron."
8th species: "Red Hematite," "Ologish Iron," "Sesqui Oxide," or "Peroxide of Iron."
9th species: "Brown Hematite," "Hydratic Oxide of Iron."
5th variety: Earthy Limonite.
10th species: "Carbonate of Iron," "Spathic Iron Ore."
17th species: "Wolfram," "Tungsten of Iron and Manganese."
Manganese—4th species: "Amorphous Pyrolusite," "Earthy," "Concreted," "Dentritic."
3rd *variety*: "Kobel's Disnite."
Cobalt—4th species: "Peroxide of Cobalt."
Tellurium—2nd species: "Auro-argentiferous Tellurium," or "Graphic Tellurium."
Antimony—2nd species: "Arsenuriet of Antimony."
Mercury—2nd species: "Cinnabar."
Lead—2nd species: "Sulphuretted Lead."
3rd *variety*: "Argentiferous Galena."
6th species: "Seleniuret of Lead."
Copper—1st species: "Native Copper."
2nd species: "Chalkosini," "Sulphide of Copper."
5th species: "Chalkopyrite," "Copper Pyrite."
11th species: "Azurite," or "Chessy Copper."
12th species: "Bibasic Carbonate of Copper." "Green Malachite."
13th species: "Atacamite," "Chloruretted Copper."
Silver—1st species: "Auriferous Silver, or Mixed Gold and Silver." Colour pale yellow.
7th species: "Freieslebenite," "White Silver Ore."
Gold—1st species: "Native Gold."
1st *variety*: "Electrum" (silver 2½ per cent. on the gold).
2nd *variety*: "Argentiferous Graphic Tellurium."

HYDRATED SILICATES OF ALUMINA.

Plastic Clay (originating from mechanical sediments), "Esmectic Iron Clay," "Calcareous Clay" (Loam originating from chemical sediment), "Metamorphic Iron Clay," "Iron-clay Slates."

ALUMINOUS AND ALKALINE SILICATES, WITH THEIR ISOMORPHS.

Feldspars—1st species: "Orthosa," "Graphic Pegmatite."
8th *variety*: "Petrosilex."
9th *variety*: "Dolerite," "Basalt."
23rd species: "Lofoite Chlorite."
1st *variety*: "Dumasite," "Common Oxiduliferous Chlorite."

NON-ALUMINOUS SILICATES.

6th species: "Ofiolite *Steatite*" (Serpentine containing Diallage).
1st *variety*: "Ollary Stone" (Lapis Ollaris).
3rd *variety*: "Metaxite."
7th species: "Olivine."
16th species: "Amphibole," "Hornblend."
17th species: "Proxene Augite," "Fibrous Asbestos."
18th species: "Talcose Diallage."

FLUATE SILICAS.

3rd species: "Mica" (Micacite).
5th *variety*: "Damourite," (Granitic Gneiss).
GENUS.—Fossil Coal, "Coal," and "Piciform Lignite containing Anthracite."

To acquaint ourselves with the said minerals, investigate their origin, history and age, without which it would be impossible for us to estimate the latter, which dates back to the colossal figure of thousands of centuries—or it may be for more—was now the object to which we ought to devote ourselves in order to attain the purpose we had in view.

VII.

No one initiated in science will refuse to accompany us in our excursion into the Sanctuary of Palæontology, to search its shrines for the effigies of the existences of the primordial fauna, which we have discovered intact, as though they had been consecrated in perpetuity, rendering due homage to its immutable law. We copied out their characters, duly respecting their Sarcophagii, where those *Paradoxides-pradoamus* and *conocephalite-subzeri* have remained entire, through which we have been able to contemplate retrospectively the thrones of geological chronologies, and read again nature in her ancient chronicles, and have been led even to tread on the later gneissic, micaceous and steatite housings of the Palæozoic period, frequently shaken in their cradle, upset and impetuously upheaved towards the light of the Sun at last, simultaneously with the upraising of the Andes by a common and ostensible cause, of which form part (among the aforesaid agalisic rocks, more or less ancient) eruptive quartz, intermixed with gold, scattered in longitudinal layers, which in a vertical direction, more or less inclined, intersect the strata of the earth over an extent of 9,000 kilometres in length, which the said system of mountains, "The Andes," mark out—a veritable mine of wealth bursting forth, represented by Gold, Silver, Copper, and the other pre-cited metals, &c., intermixed in the seams of the said quartz, with phorphide and pegmatite.

Thus it was that we were enabled on the above-mentioned territory, including that of Uruguay, to follow the lanes of geological life from the remote past down to the present; that is to say, from the time when the flora and the fauna were brought to the light of day in the Silurian world, succeeding to or co-existent with the Devonian, having seen them in great part survive and multiply, with new lineages born in the Carboniferous, losing some power and lustre in the *Permic*, and amid changes and mutations push forward, under the influences of climates and elements little favourable to the flora, but more so to the fauna, until reaching the present epoch of quiet, and seeing that this was preceded by a deluge, that of Moses, brought about by the upheaval of the "21ST SYSTEM OF MOUNTAINS," which doubtless in connection with its predecessors may figure in the category of a great rain.

Let us proceed in our epoch of present quiescence, and we can always note that the days succeed one another, thus increasing the number of civil years and geological seconds; and in this sequence what does it matter, that "Solfatara" presents us with its sulphur, although not very agreeable if we inhale it; that "craters" emit their Lava, and the geysers their outpourings of Silicas in their nascent chemical state, afterwards transformed into a jelly, and thus endowing with beauty the objects which it laved, by a pellicle or surface of striated crystal, more or less molecular, with all the lustre of its white hyaline; that the "Macalubas" emit muddy substances, and that the springs of Carbonic Acid snatch away the life of whoever goes to this source to quench his thirst? Does the thermal spring worry us, or that we are guaranteed from a geological cataclysm by 600 or more chimneys, through which the incandescent mass in the interior of the globe finds an outlet?

Happy in this period of life, the trchytic epoch, we contemplate the tokens of the scenes which precede its eruptions; we are fortunate enough, without waiting for their vespers, which are already passed and gone; we prefer the possibility of the "lava" and "trephine" epoch, that is to say, that in which Oxygen has as a moderating agent, Azote; that wherein vegetable life grows old by years or days, and not by hours, as in the spring-tide of its existence (never mind its being more or less shaky); in that age when the foliage of the "Calamite" and of the "Fern-filix" (helecho) do not over-shadow the mountain crest, and on the contrary, as if ashamed, hide their diminutive size in the dark cliffs of the summits and even in the grottos from the light of the sun. Neither was the *Nothosaurus-giganteus* (zoology), although more recent than those vegetable existences, permitted to show its tottering form; it reaches from the "Triasic" World to the "Cenozoic," and when by wasting it no longer found a place, it accepted senectitude and then the grave. Let us consider this, the end of that great reptile and of the other species of its epoch, and not think that the Lizard of our time is its representative. Nor must we believe that the ancient inhabitants of the primordial seas, the *Onchus tenuistriatus,* still exists; its funeral relics are all that are left.

VIII.

This is what we also observed in the region of Tacuarembó! But such a repetition of facts and of accumulated inorganic existences have made evident to us its analogy with the other pre-cited AURIFEROUS DISTRICTS AND REGIONS, whilst its Palæontological evidences indicate an epoch not far distant from the others. The resemblance of the petrographic physiognomy, no less than that of the *Saxean,* the latter represented by mounds of quartz structured in tuffs, dykes, seams, veins, and threads, all, in constitution, of a family bordering on other eruptive rocks, as well as the magnitude and variety of the georographic reliefs, all concurred in authorising us to establish the analogy of this rich REGION with the others similarly privileged in wealth.

At first, and without the experience of succeeding years, we were surprised with regard to its richness, so that in the tuffs and dykes of Silicic-Anhydride-Acid, we did not recognise the existence of Gold and other metals; but the time came when the minutest details being ascertained, the true wealth which was to be found in the dykes, would be manifested to us. Indeed, in the Sierra d'Aracuá, one dyke in the said rock, of more than 80 metres in thickness, by 500 in length, contains Gold: the same occurs in the other places in the district of Yaguari, at Cuñapirú, and Corrales, and we are going to refer to a very small portion only of these two districts, without it being thought that it relates to the 400 square leagues of territory, more or less, which the said auriferous region of Tacuarembó comprises or represents. Our limit in the present account is confined to a perimeter of one square league of ground. And although we reserve the right of referring to it later, we will, meantime, beg to subtract from the said league twenty-three square "*cuadras,*" equal to about seventeen hectares, occupied by the Gold Mine called "San Gregorio," (see the Industrial Geographical Plan, Annex No. 3, which accompanies the present pamphlet), known as General Suarez, but now the property of Don Antonio M. Marquez; a mine constituted or formed by several veins of "quartz," "pegmatite," and other rocks of eruptive origin in this form; a "tuff" of auriferous quartz of a whitish alabaster and white ashy-iron colour (sample No. 13.), ninety metres in thickness on an average, and 360 metres long, and of indefinite depth;[*] a dyke of "pegmatite" (sample marked No. 14.), of a thickness of forty metres, by eighty in length, dislocated in some places and isolated in others, and, as it were, compressed on certain points; another "*tuff*" of "*auriferous quartz*" of a milky-white colour (samples Nos. 15, 15a, and 15b.), of considerable thickness and length, and several veins and threads of auriferous quartz of this latter colour, and in addition, other arteries of rocks of analogous origin.

Such are the seams or veins which cleave at angles of sixty and ninety degrees of the "*thermo-skeleton rock*" of the above-mentioned mine of "San Gregorio" (from which have already been extracted above seventeen arrobas of Gold, notwithstanding that the Ore is almost intact, or without being worked profitably, and all piled up on itself), and from this small portion of the soil of the district of Corrales (the twenty-three "cuadras" already mentioned), "*Silicic-Anhydride-Acid*," or "Auriferous Quartz," could be got for years, at the rate of 700 tons per day of twenty-four hours, which makes a total of 16,800 tons per month (of twenty-four working days), or 201,600 tons a year, the Ore from which contains per ton[†] three ounces of Gold.[‡]

The 201,600 tons cost, at the rate of 56 francs[§] each, as a maximum, up to the moment of delivery of the gold in bars, or melted at the smelting works, on board in the River *Corrales*, or else at Cuñapirú, 11,289,600 francs.

The output, as well as the cost, are calculated on incontrovertible bases, which the nature of this work does not allow of our specifying in detail.

In the preceding calculations we have borne in mind the

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[*] The calculation of 90 metres in thickness, by 360 in length, by 1,000 in depth, for instance (since it is indefinite), multiplied by 2·50 specific gravity, as an average, multiplied by 3 ounces of gold (say 86 grammes 13 centigrammes) for each ton of quartz, gives a sum of millions of dollars which this mine is capable of yielding.

[†] Ton of 918 kilogrammes 800 grammes.

[‡] Three ounces of Gold at the rate of 28 grammes 71 centigrammes to the ounce, are equal to 86 grammes 13 centigrammes. Three ounces of Gold are obtained per ton of Quartz, if the classes "flower" and "firsts" are worked to a profit. Quartz is divided into 1st, 2nd, 3rd and 4th classes. The whole is capable of yielding a profit, but all these classes mixed up, and separating the 3rd and 4th, they yield a half ounce of gold maximum per ton of quartz in the mine of San Gregorio, and in other similar ones in the auriferous region of Tacuarembó.

[§] We take the price of 56 francs per ton (it is the price charged by the French Company of the Uruguayan Gold Mine). But this price is absurd. Once a railway is made from the mine to the works, and the operations are scientifically conducted, the cost would only be 18 francs per ton of quartz.

"preparatory works," and the constructions of mills and engines, for the setting up of which at least a year and a half will be required; during this time, in which the ore would not be crushed in any large quantity, the profits mentioned would not be made, and will not therefore correspond with the data we have given above.

The calculation of the Cubic metre, carried out in shaft or gallery, as well as for the works in straight gradients (although the latter is less costly), the structure, texture, compactness, hardness of the rock, stratification, the efflux or influx of water;* the strength of the entablements, cost of the work or boring of the rock by means of drills or use of other corresponding tools, and the repairs of same; the cost of dynamite, slow-match, light, workmen in general, outlay for wages, including those of the carriers, engineers, stokers, and the rest of the staff engaged in the external works of the establishment; the body of foremen of the works, and the keep of the said staff; the cost of wood for fuel for the engines, kitchens, and smelting of the metals by charcoal;† the body of experts, the management, the transport of the Ores to the works; the Insurance premiums which have to be paid for forwarding the Ores, gold and silver, to Europe; State dues, and extra unforeseen expenses, have all been taken into account.

IX.

We must bear in mind that the Mine of "San Gregorio" has served as a basis from which to make the foregoing calculations, and the cause of these and of the Mine itself, is the existence of the "Auriferous Quartz" structured in tuffs, dykes, seams, veins, and threads which are contained in the said soil, together with other dykes of common and graphic pegmatite seams of "Slaty Serpentine" (sample No. 17), and others of "granular amphibole" (Diorite) and "Micraceous Amphibole," all intermixed with layers of "Oxyduliferous-Chlorite-Slate" and "Crystalline Slates" not far distant from the "Granite Gneiss."

We must not omit to mention that the surface of this Mine consists of a vegetable layer, and a sub-soil formed of gravel, stones, chinas, grava, fine and coarse sand, silicic-ferrugineous-clayey-earths, etc., half a metre in thickness, on an average, which represents at least 29,515 tons of Ore,[*] and that from each ton Gold can be extracted from the fragments of quartz mentioned, from the earth, of the surface and sub-soil in nodules and grains (Sample No. 18; specific gravity 12·90) at the average rate of 4 dollars, or 7 grammes 17 centigrammes. We refrain from giving further particulars on the 23 (Cuadras) deducted from the square league, to which we have referred above, and in which is included the concession known as "San Pablo" of 1,600 hectares of land; a concession which comprises in addition to the above named mine, eight other mines of equal importance; and like it, they have been worked since 1866, and thousands of tons of ore have been extracted from its galleries, shafts and rubbish. From the "flower" of this ore or a minimum portion which has been crushed by hand in mortars, and from grains and nodules gathered from the surface and sub-soil of the vegetable bed, and from a quantity of tons crushed, for an assay, by machinery, in 1869, at the Establishment situate at "Tres Pasos" on the river Cuñapirú, a return of no less than Eleven Arrobas of Gold was obtained.

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* In the calculation there has been taken into consideration, the stratification of the soils of the whole district, the annual rainfall, the external hydrographic springs with their currents, overflows, etc., and no importance has been attached to the inner springs, as they may be considered exceptional in this region, owing to its geological nature.

† The use of Coal for the engines of the Mine, and the calcination of the Ore, whether common Coal or Coke, would increase the cost of each ton of Ore.

The above "San Pablo" concession, which is at the present time being worked by the "French Company of the Gold Mines of Uruguay," is of such importance that, although its veins have not the depth of those of the "San Gregorio" Mine, and are more scattered, it may very possibly, altogether, yield a product of 700 tons of auriferous quartz of like richness, which will also be got, per day of twenty-four hours, from the mines of this concession, reckoning from the time when the preparatory works shall have been completed, allowing of the introduction of a sufficient working staff. Along with this must go the establishment of various Crushing Mills (Smelting Works) on the rivers Cuñapirú and Corrales, in addition to the one which is in course of construction by the above "French Company," and which will crush up to eighty tons per day of twenty-four hours, all of which works will be able together, at once, to turn out 2,000 tons of Ore daily; 7,000 workmen engaged in extracting it, with the corresponding staff and the setting up of works capable of crushing 3,400 tons of Ore per day is what is wanted in the first place for these mines, which occupy, in conjunction with those of the banks of the river "Los Corrales," three square leagues of the fifty comprised in the district of Cuñapirú, and of the 400 of which the region of Tacuarembó is composed. Such are the works which it is necessary to carry out exactly in order that they may be said to be worthy of this said region.

In addition to the "San Gregorio" Mine and the above-mentioned concession of "San Pablo," there exists in the said square league the Mine of "Santa Barbara," of Torregrosa, which although it contains solely two veins of quartz, of eighty-six centimetres in depth, by about 300 metres in length, is important by reason of its Ore containing three ounces of Gold per ton (86 grammes 13 centigrammes).* The Mine of "San Pedro," situate on the left bank of the river "Corrales," is no less rich, but even superior; its veins of "argentiferous-gold-quartz," of great depth, are interlaced and form a network. There are also other mines adjacent to the latter, formed by veins and threads of analogous rock, but they are of less importance.

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[*] The calculation of 29,515 tons of Ore from the soil and sub-soil does not refer to the 23 "Cuadras," but the four concessions := 8 cuadras which form the centre of the mine of "San Gregorio," and represent 59,030 metres 48 centimetres of square superficial area, per half metre of minimum thickness, equal to 29,515 tons, estimating the specific gravity of each cubic metre at a ton instead of 150, which is the proper estimate.

Outside the perimeter of the square league exist also the ancient mines of "San Antonio," "L'Oriental," "San Rafael," "Apolo," "Santa Ana," "Santa Marta," "Rocherd," and "Castrillon," from which can likewise be got a minimum of 2,000 tons of Ore per day. We reserve to ourselves, on a more convenient occasion, the opportunity of speaking of the importance of these mines respectively.

There exists veins of Quartz (tuffs and dykes) in a virgin state, which are equal in their category to the Mine of "San Gregorio."

X.

In addition to the Arteries of auriferous quartz existing in the mines alluded to, which have been the object of the workings of the mining industry for several years, as well as of every sort of analysis and investigation during this time, we must remember that the district of Cuñapirú as well as that of Corrales and of Yaguari and Caraguatá, reveal more than 380 to 400 veins of auriferous quartz which are worth working, and it is possible that a still greater number are contiguous and only await discovery.

We must bear in mind that from the veins of auriferous quartz alone (in regular deposits or beds), which are present over a square league or area situate near the confluence of the streams Cuñapirú and Corrales (one league of the 400, comprised in the region of Tacuarembó), must give in the course of years 1,400 tons of the said Ore, which may be easily got daily, which makes a yearly total of 403,200 tons, each containing three ounces of gold,† and about twenty-eight per cent. of this quantity of silver.‡ To do this, however, machinery is required capable of working the said Ore; for what is only now performed at the rate of eighty tons per day is very far from meeting the most preliminary requirements of the region in question.

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* Yields three ounces of Gold for each ton of Quartz, this, however, being of the "Flower" and First and Second qualities. If the Quartz of the Third and Fourth qualities is worked, it yields eight dollars per ton. *See* page 35.

† The extraordinary yield of the class called "Flower," and of the quartz of the first and second selection, produced the result already mentioned.

‡ The twenty-eight per cent. of silver is discounted in specific weight from the weight of three ounces of gold.

We must also bear in mind that if in the labour and working of the veins contained in the said square league the sum of 60,000,000 francs be laid out in the first four years, supposing that up to that time, owing to the works not being completely ready, no Ore shall have been treated, and that an outlay in the purchase of machinery, transport, and cost of setting up establishments respectively, is incurred of another 10,000,000 francs, amounting with the previous sum to 70,000,000 francs; and this being granted, and that the Capital invested gradually and as occasion requires during these four years receives no interest at all; nevertheless, at the close of the following year, the fifth year of the undertaking and the first of production, the return would take place of 86,465,408 francs in gold obtained from the 403,200 tons of quartz elaborated or crushed within the same year, without reckoning the value of the twenty-eight per cent. of silver approximately contained in the gold produced by the same process of refining. Would, then, there be any loss in the outlay of the said sum in the course of four years, even if slightly exceeded up to the end of the fifth year, and the repayment immediately of the whole of the Capital, and even more than the sum stated, insuring in this manner the annual receipt of a like sum, at least for a series of years in succession without any disbursement? Instead of losing, a lasting income would be insured for, at the very least, some dozen years.

But let us suppose that instead of each ton of ore containing three ounces of gold, along with the silver as before stated, one half of it should contain only one-and-a-half ounces of gold without any other metal in conjunction therewith; would the operation fail to return from the mines of Tacuarembó, after five years of work, half of the Capital invested, on entering on the fifth year of work and the first of profit—a return which would henceforth be an annual one, continuing for a series of years? Has the Capital invested any right to require a premium for its use of 20 per cent. interest per annum and 5 per cent. sinking fund? That is correct. But as the mines of Tacuarembó give a return of 50 per cent. interest per annum for payment conjointly of the interest and sinking fund, can more be required from them? Are there, perchance, any gold mines in the regions and districts mentioned at the beginning of this Pamphlet, or in other parts of America or Europe, which are capable of giving such a return on the Capital invested? If there be any such, where are they? Were we right in setting forth the analogy between the auriferous region of Tacuarembó and the others in America? The preceding demonstrations speak for themselves.

But it may be said: "How is it possible to employ, in some four years or more, a capital of 70,000,000 francs and upwards, in the mines of Tacuarembó, however rich they may be? Quite right; but we are ready to give a reply. How is it that in the

United States of N. America, for the mines of California, Virginia, Colorado, New Carolina, Massachusetts, and Missouri, the gold mines of which are no better than those of Tacuarembó, fifty-six Mining Companies have been formed for opening up and working the gold and silver mines, and among these two of them with a capital of 54,000,000 dollars, that is to say, of over 270,000,000 of francs each? We will take the liberty of mentioning these Companies and their Capital as represented in the City of New York. 1st, the "Alpha" Mining Company, Capital 3,000,000 dollars; 2nd, the "Belcher," Capital 10,400,000; 3rd, the "Bertha," Capital 300,000; 4th, the "Best and Belcher," 10,800,000; 5th, the "Bullion," 10,000,000; 6th, the "Caledonia," 10,000,000; 7th, the "California," 54,000,000; 8th, the "Centennial," 10,000,000; 9th, the "Chollar-Potosi," 2,800,000; 10th, the "Cleveland," 2,500,000; 11th, the "Hercules, etc., Roc," 1,000,000; 12th, the "Imperial," 50,000,000; 13th, the "Nort Llope, etc., Evaust," 500,000; 14th, the "Virginia," 54,000,000; 15th, the "Confidence," 2,496,000; 16th, the "Crown Punt," 10,000,000; 17th, the "Dougias," 1,000,000; 18th, the "Eureka," 5,000,000; 19th, the "Exchequer," 10,000,000; 20th, the "Gould, etc., Curai," 10,800,000; 21st, the "Grandt Mining Company," 10,000,000; 22nd, the "Granville," 1,000,000; 23rd, the "Hale, etc., Nocross," 11,200,000; 24th, "Hukill," 1,000,000; 25th, the "Indian Queen," 300,000; 26th, the "Julia," 11,000,000; 27th, the "Justice," 10,500,000; 28th, "Kentuky," 300,000; 29th, the "Kossuth," 5,400,000; 30th, the "Leopard," 5,000,000; 31st, the "Lucerne," 5,000,000; 32nd, the "Compañia del Túnel de los Comerciantes y Mineros," 500,000; 33rd, the "Merrimac," 500,000; 34th, the "Mexican," 10,080,000; 35th, the "Morning Star," 8,000,000; 36th, the "Northern Belle," Compañia de Minas y Molinos, 5,000,000; 37th, the "Ophir," 10,800,000; 38th, the "Original Cornstock," 10,000,000; 39th, the "Overman," 3,840,000; 40th, the "Pleasant View," 200,000; 41st, the "Raymond, etc., Ely," 3,000,000; 42nd, the "St. Joseph Lead Company," 1,000,000; 43rd, the "Santiago," 11,200,000; 44th, the "Savege," 11,200,000; 45th, the "Segregated Belcher," 640,000; 46th, the "Sierra Nevada," 10,000,000; 47th, the "Silver City," 6,310,000; 48th, the "Silver Hill," 10,800,000; 49th, the "South Cornstock," 10,000,000; 50th, the "South California," 5,000,000; 51st, the "Southern Star," 6,000,000; 52nd, the "Trenton," 10,000,000; 53rd, the "Union Consolidated," 10,000,000: 54th, the "West Belcher," 10,000,000; 55th, the "Yellow Jacket," 12,000,000; 56th, the "Young América Mining Company," 3,000,000 dollars.

We will then, briefly say that in the Auriferous Region of Tacuarembó there are grounds for the establishment of fifty-six Mining Companies, like those of "California," "Virginia," &c., with not inferior capitals—grounds which are a real and positive fact, establish the veins mentioned of eruptive quartz, of which rock, in its various deposits, depth, and length, native Gold forms an integral part, and it is proved to contain in its contexture, gold sometimes irradiated, sometimes intermixed and interwoven (in the rock) in a compact and solid mass, sometimes forming kernels, and also as it were, pressed together, and more frequently in filaments, arborisations, bunches, flakes, lamina, molecules, and atoms; and almost everywhere associated in the same mass of rock, also as an integral part of it, "Native Copper," forming layers (this is not general, but except only in certain veins), "Sulphurated Pyrites," "Carbonates of Bibasic Copper and Sesquibibasic Hydrates" (Azurite and Malachite), Native Arborescent Silver, filling up fissures (sample of Argentiferous-gold-quartz, No. 19, at Cuñapirú) "Sulphurated," and constituted with Lead, giving formation to Crystals of "Galena" (sample marked No. 20). Iron in the form of oxides, combined with Sulphur, constitutes crystals (pyrites), generally in association with radiated and magnetic pyrites, with "oligist hematite," and "oxidulated loadstone," &c., in some veins, and also with "Cobalt," "Arsenic," and "Antimony" in others, with "Tellurium," and in others with "Platinum," "Rhodium," and "Irridium" (these last are less common).

The quartz and the metals it contains in an integral mass erupted to the surface of the earth in a state of ignition, proceeding from the inner incandescent mass of the globe; and the structure it presents is that proper to the form of fissures and interstices, produced by contractions of the solid crust, which the said incandescent mass filled up with a portion of itself, and to that which the quartz and metals they contain, represent; just as the other rocks of eruptive and igneous origin represent it, and for the same reason both classes of rocks reach downwards to an indefinite depth, and there is no reason to suppose that, at this great depth, the metals they contain are any less abundant than at five metres below the surface,* nor that they disappear or dissolve. The region of Tacuarembó is akin to that of Córdoba (Argentine Republic), "Minas Geraes," Merida, California, and others before mentioned, in which (in the three latter) there are already in existence, workings at a depth of over 600 metres, along veins which, at this great depth, are of greater thickness than at the surface, and no less rich in gold and the other metals indicated, without there being any traces of the hydro-thermal action having played the principal part therein. In making the calculations on the yield of gold from the "San Gregorio" mine, we did not include that which is contained in the tifon of milky quartz, nor in the threads; and we omitted that which is present in the pegmatite, and may be present in the Serpentine and the Amphibole, both in this mine and in the "San Pablo" concession.

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* Since the year 1882, up to this date, shafts have been made in the mines of "San Gregorio" and "San Pablo," forty metres in depth, and gold continues to be found in the same proportion as in the quartz at five metres from the surface.

Montevideo, 11th February, 1888. THE AUTHOR.

That the diluvial deposits contain gold in the form of nodules, grains, moleculos and atoms, is a matter of public notoriety.

The above region is capable of yielding, for the space of many years, at least 20,000 tons of quary and other erruptive rocks containing gold in quantities of from half-an-ounce to an ounce of gold per ton, per day of 24 hours. The working of millions of tons of auriferous ores, forming mounds of more or less greater depth, from the washings of the plains and alluvial lands is capable of yielding considerable quantities of gold in nodules, grains, &c.

It is also correct that it is desirable to set up a sufficient quantity of machinery to work 20,000 tons of Ore or more per day. The region described will allow of the advantageous employment within itself of 100,000 miners and corresponding staff. And in conclusion, unexceptionable conditions as to climate, harmonise with a soil excellent for the mining industry, as well as for agriculture and cattle raising. Such is the Auriferous Region of Tacuarembó.

CLEMENTE BARRIAL POSADA.

This description was published, in part, in January 1881, in the newspapers, " El Siglo " and " El Bien Publico," of Montevideo ; and has been now added to and extended by the enumeration and description of the specimens of Ores presented by the Author to the Continental South American Exhibition of 1882, at Buenos Aires.

Revised in February 1882, by the author, for the Barcelona and Paris Exhibitions of 1888 and 1889.

We have issued two Reports, the first entitled

GEOLOGICAL NATURE
AND
OROGRAPHIC CONTEXTURE
OF THE
REPUBLIC OF URUGUAY.

And the second :

NATURAL RICHES
CONTAINED IN THE
TERRITORY OF THE REPUBLIC OF URUGUAY.
CAPABLE OF BEING UTILISED BY
INDUSTRY AND COMMERCE.

THESE two reports, as also the present one, destined for the Continental South American Exhibition, at Buenos Aires,* refer to the special importance of the Territory of Uruguay, to which it particularly relates. And in order to confirm in an incontrovertable manner the facts set forth, we undertake the duty of sending to the said Exhibition a few specimens of the Ores, which we retained in our possession out of collections forwarded to Europe and the United States of North America some years ago. To this end we divide them into two sections, to correspond with the places whence they were taken, the one being the Northern Territory and the other the Southern of the Republic with respect to the Rio Negro, which divides it almost at the centre.

The specimens catalogued below, from No. 12 upwards, belong to the Northern Section of the said river. We likewise include eleven specimens of Ores from the Province of Cordoba (Argentine Republic).

ARGENTINE REPUBLIC.

Specimen marked Number 1, *Granite Gneiss,* from the province of Cordova, Department Cruz del Eje.

Number 2 *Ollary Stone* (Lapis Ollaris), from the province of Cordova.

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* And now intended for the Exhibitions at Barcelona and Paris of 1888 and 1889. —THE AUTHOR, Montevideo, February, 1888.

Number 3 *Auriferous Ferruginous Alabaster-like Quartz*, from the province of Cordova.

4 *Steatite Serpetinne*, from the province of Cordova.

5 *Granite Gneiss* with Argentiferous appearance, from Candelaria, from Cordova.

6 *Granite*, composed of *Quartz, Feldspar, Turmaline* and *Mica*, from Bragada, province of Cordova.

7 *Argentiferous Lead*, specific gravity 6·80, from the mine "Neuvo Gobierno," department Cruz del Eje, province of Cordova.

8 *Blende* or Argentiferous Carbonate of Zinc, specific gravity 3·70, from the mine "Nino Dios," province of Cordova.

9 *Argentiferous Gold Copper Quartz*, from Bragada, province of Cordova.

10 *Auriferous Quartz*, from Patacon, province of Cordova.

11 *Silicic Anhydride Acid*, or *Hyaline Quartz, Rock Crystal*, from the Cordillera of "San Luis," province of Cordova.

REPUBLIC OF URUGUAY.

12 *Auriferous Quartz* (Silicic Anhydride Acid, specific gravity 2·50), from the mine "San Pablo," situate in the Auriferous region of Tacuarembó.

12*a* *Silicic Anhydride Acid*, or Auriferous Ferruginous Alabaster-like Whitish Quartz, from the mine of "Santa Bárbara," of Torregrosa, in the region of Tacuarembó.

12*b* *Gravel of Auriferous Quartz*, from the surface of the mine of "San Gregorio," specimen of detritus and loose stones which form part of the soil or bed of the Auriferous region of Tacuarembó.

13 *Graphic Pegmatite*, from the mine "San Gregorio," situate in the Auriferous region of Tacuarembó.

13*a* *Graphic Miliary Pegmatite*, from the Auriferous region of Tacuarembó.

14 *Chlorite*, coloured by Carbonate of Copper, from the Auriferous region of Tacuarembó.

15 *Micaceous Amphibole*, from the district of Corrales, Auriferous region of Tacuarembó.

16 *Silicic Anhydride Acid* (specific gravity 2·60), an Auriferous Milky-like Alabaster Quartz, from the mine "San Gregorio," district of Corrales de Cuñapirú, Auriferous region of Tacuarembó.

16*a* *Auriferous Ferruginous Quartz* (specific gravity 2·55), glittering Ore from the mine "San Gregorio," district of Corrales de Cuñapirú, in the Auriferous region of Tacuarembó.

Number 17 *Serpentine* (specific gravity 2·80), from the mine "San Gregorio," region of Tacuarembó.

18 *Native Gold* (specific gravity 12·90) from the ancient alluvial land, which forms the soil and sub-soil of the mine of "San Gregorio," and a large part of the soil and sub-soil of the said region.

19 *Quartz containing Gold and Silver in fibres;* the latter fills cavities in the rocks—this rock, moreover, contains Sulphurated Iron Pyrites, of which Gold forms an integral part; from the Auriferous region of Tacuarembó.

20 *Auriferous Argentiferous Quartz,* which, in addition, contains Sulphurous Copper-pyrite, Sulphurous Iron-pyrite, and Oxide of Iron; from the San Gregorio" mine, in the Auriferous region of Tacuarembó.*

ROCKS OF ORGANIC ORIGIN.

GENUS BITUMEN.

3rd SPECIES OF ABOVE.

21 *Asphalt,* from the department of Tacuarembó.

GENUS COPPER.

1st SPECIES.

22 *Native Copper.* Two specimens from the North of the Rio Negro.

5th SPECIES.

23 *Chalkopyrite*—Crystallized Copper, from the department of Salto.

24 *Copper pyrites, dark variegated colour*—Chalkopyrite, department of Salto.

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* Wishing to work certain veins of Auriferous Quartz in the region of Tacuarembó, in the Copper region of Salto, and also in other localities in the territory of this country (Uruguay), there has just been formed in London, in January last, a Company, entitled "The Gold Fields of Uruguay," with a capital which may be raised to 20 millions sterling, equal to 100 millions of dollars, which Company is entirely due to our information, plans, specimens, and other unceasing scientific labours, carried out since the year 1866. The said Company has acquired the Gold mine of "San Gregorio," the property of Señor Antonio Maria Marquez, the present Minister of Finance, for the sum of *one million dollars* (1,000,000), and devotes another half million, or one hundred thousand pounds sterling for its working.

Montevideo, February 1888.

CLEMENTE BARRIAL POSADA.

GENUS SILVER.

5th SPECIES

Number 25 *Sulphurate of Silver, or black Silver*—Silver glauce, from the North of the Rio Negro.

GENUS LEAD.

26 *Galena*, from the South of the Rio Negro.

GENUS IRON.

2nd SPECIES—MARCASITE (IRON PYRITES).

27 *Sulphuretted Iron Pyrite*, from the department of Minas.

OXIDISED ORES.

2nd SPECIES.

28 *Hematite Iron*, from the department of Paysandu.
29 *Himonite Iron in grains*, yellow ochre, from the department of Salto.
30 *Chromate of Iron*, variety of Hematite.
31 *Oxidulated Magnetic Iron*, from Cuñapirú.

GENUS MANGANESE.

32 *Blue Manganese*, from the department of Tacuarembó.

AMPHIBOLIC OR CRYSTALLIZED STONES.

33 *Raicolite Pyroxene*, from the department of Tacuarembó.
34 *Pyroxene Augite*, from the department of Tacuarembó.
35 *Basaltic Amphibole Hornblend Pyroxene*, from the department of Tacuarembó.
36 *Granular Pyroxene, Cocolite*, from the department of Paysando
37 *Diallage Rock* (*eglogite*), from the department of Paysandú.
38 *Asbestos*, from the department of Tacuarembó and Cuñapirú.
39 *Ancient Green Labradorite Porphyry*, from the department of Tacuarembó.

SILICATES OF ALUMINA, LIME, AND THEIR ISOMORPHS.

40 *Oriental Garnet*, from the department of Salto.
41 *Calcarius Garnet*, from the department of Soriano.

FLUATE SILICATES.

Number 42 *Topaz,* from the department of Durazno.

NON-ALUMINOUS SILICATES.

43 *Basalt* (variety Dolerite), bell-stone in the country, from the department of Tacuarembó.

44 *Amygdalite*—BASALT containing *Anhydrous Calcydony* (specific gravity 2·60), from the department of Salto.

SILICIC ANHYDRIDC ACID (QUARTZ).

45 *Rock Crystal* or *Hyaline Quartz,* from the department of Salto.

46 (1st SUB-SPECIES). *Amethyste* or violated Quartz, from the department of Salto.

46*a* *Prismatic Radiated Rock Crystal—Rose Crystal,* violated Quartz, from the Department of Salto.

47 *Rock Crystal,* do. Imitation Topaz Quartz or Hinojosa, from the department of Salto.

48 Ditto *Hemaloid Quartz,* from the department of Salto.

49 (2nd SUB-SPECIES). *Lithoid Quartz,* from the department of Salto.

50 *Crisoprase Onyx-Calcedony,* from the department of Salto.

51 *Yellow Calcedony,* from the department of Paysandú.

52 *Anhydrous Calcedony,* of concrete structure and botroidal texture, surface as it were cleft, the effect of the shrinking of the Silica in drying, from the department of Tacuarembó.

53 *Anhydrous Calcedony,* do. do. Silicic incrustation in Basaltic rock, from the department of Salto.

54 *Anhydrous Calcedony,* concreted Silica of botroidal texture, cleft, with nodules also of Silica, loose in the concave interior, from the department of Salto.

55 *Streaked Jasper,* from the the department of Paysandú.

56 *Egyptian Jasper,* from the department of Soriano.

ALUMINOUS SILICATES.

57 *Bituminous Clay-Slate,* from the department of Tacuarembó.

58 *Argillophide,* from the department of Paysandú.

60 *Sharp Lustrous Sand,* compact Marl Sand, from the department of Paysandú.

GENUS LIME.

3rd SPECIES—DOLOMITE.

Number 59 *Dolomite.*—Magnesian Limestone, from Cuñapirú.
60 *Silicious-Aluminous Limestone* (compact marl).

5th SPECIES—PLASTER (GYPSUM).

60*a* *Selenite Spar,* from the department of Tacuarembó.

SOUTHERN SECTION OF THE REPUBLIC.

To the Southern Territory belong the minerals of the specimens which are described at foot.

ROCKS OF ORGANIC ORIGIN.

GENUS FOSSIL COALS.

2nd SPECIES—GRAPHITE—3rd *variety.*

Number 62 *Compact Graphite,* from the department of Florida, mines of same.

5th SPECIES—LIGNITE—6th *variety.*

63 *Brown fibrous Lignite* or *Bituminous Wood* (fossil wood), from the department of Cerro-Largo.

6th SPECIES—PEAT—1st *variety.*

64 *Compact Peat* or *Piciform,* from the department of Maldonado.

GENUS IRON.

65 (2nd SPECIES). *Marcasite, Sulphurated Iron, Martial Pyrite,* incrusted in Chloritic Rock, from the department of Florida.
66 *Sulphurated Iron Pyrite,* enclosed in Silicious Limestone Rock, from the department of Florida.
67 (4th SPECIES). *Magnetic Pyrite,* an old red gravel, from the department of San José.
68 (6th SPECIES). *Oxydulated Iron, Magnetic, Black Oxide of Iron,* from the department of Rocha.
69 *Magnetic-Oxydulated Iron, Black Oxide of Iron,* in Vitreous Quartz, from the department of Maldonado.
70 (1st *variety*). *Iron Oxide, Magnetite* or *Oxydulated Iron,* from the department of Rocha.

Number 71 (2nd *variety*). *Oxide of Iron, Crystalised micaceous brilliant silicic-aluminous* (36 per cent. metallic iron, 50 per cent. silicic), from the department of Maldonado.

72 (5th *variety*). *Foliated Iron, Fibrous* or *Green Magnetite,* from the department of Minas.

8TH SPECIES OF GENUS IRON.

73 (3rd *variety*). *Red Compact Hematite Iron,* from the department of Florida.

74 *Compact Red Hematite Iron,* from the department of Florida.

75 *Hematite Iron,* from the department of Florida.

2nd SPECIES.

76 (1st *variety*). *Limonite in Rock—Clay Hematite Iron,* from the department of Florida.

77 (7th *variety*). *Chamoisite* or *Oxidized Hydrate, Silicic Aluminous Iron,* department of Cerro-Largo.

10th SPECIES.

78 *Mena of Iron,* similar to the *Siderite,* from the department of Maldonado.

79 *Carbonated Iron* (specific gravity 3·70), from the department of Montevideo.

GENUS MANGANESE.

4th SPECIES.

80 *Earthy Pyrolusite, Peroxide of Manganese,* from the department of Tacuarembó.

81 *Granular Pyrolusite, Peroxide of Manganese,* from the department of Rocha.

4th SPECIES.

82 *Conglomerated Pyrolusite, Peroxide of Manganese,* contained in *Rock Flint* (*Coarse Agate Quartz, and Silicate of Potash*) (specific gravity 2·40), from the department of Maldonado.

14th SPECIES.

83 *Disnite of Kobel,* or Aluminous Silicate of Iron and Manganese (specific gravity 3·60), from the department of Tacuarembó.

GENUS TELLURIUM.

2nd SPECIES—MULERITE—3rd *variety.*

Number 84 *Auriferous Argentiferous Tellurium,* from the department of Maldonado.

GENUS LEAD.

2nd SPECIES—GALENA.

85 *Silver Cuprous Lead,* from the department of Maldonado.

86 *Sulphuretted Argento Cuprous Lead,* from the department of Minas.

GENUS COPPER.

10th SPECIES—2nd *variety.*

87 *Oxydulated Copper,* Protoxide of Copper (specific gravity 5·20), from the department of Maldonado.

12th SPECIES—1st *variety.*

88 *Green Malachite,* Carbonated Copper (Copper and Carbonic Acid), from the department of Minas.

16th SPECIES—OLIVENITE.

89 *Olivenite,* Arsenate of Copper, from the department of Minas.

18th SPECIES—CRISOCOLE.

90 *Silicate of hydrated Copper,* Resinite Copper, from the department of Maldonado.

GENUS SILVER.

5th SPECIES—ARGIROSA.

91 *Sulphuretted or Black Silver,* from the department of Minas.

GENUS ALUMINOUS SILICATES.

3rd SPECIES—ANDALUSITE.

92 *Adamantine Feldspar Andalusite,* from the department of Montevideo.

GENUS HYDRATED SILICATES OF ALUMINA.

4th species—Thon.

Number 93 *Legamo Pampero or Coarse Reddish Clay.* This Legamo constitutes the living or vegetable bed in South America, and in extent 180,000 *square leagues;* in it are found the fossil remains of the Megatherium, Glyptodon, Clavipes, &c., representing the Quaternary period. The specimen produced comes from the department of Montevideo.

93*a* *Clay Slate, Palæozoic* land, from the department of Florida.

94 *Graphic Slate,* from the department of Florida.

95 *Bituminous Slate,* from the department of Cerro Largo.

96 *White Slaty Clay,* from the department of Rocha

97 *Slaty Clay,* with fossil impressions of *Annularis longifolia,* from the Carboniferous land of the department of Cerro Largo.

98 *Aluminous Slate, Silicic Ferruginous,* metamorphosed, compact Red Ocre, from the department of Maldonado.

ANHYDROUS SILICATES OF ALUMINA.

99 *Breachiform-reheated Clay—Argilolite* (variety of Termantide), from the department of Maldonado.

100 *Reheated Clay* (variety of Termantide), from the department of Montevideo.

101 *Porcelanite* (Friable Quartz), integral, metamorphic Clay of Carbonated Iron, from the department of Montevideo.

GENUS ALUMINOUS AND ALKALINE SILICATES, WITH THEIR ISOMORPHS.

1st species—Orthose.

102 *Adular,* Feldspath, from the department of Montevideo.

103 *Orthophide,* Porphyric Granite, Petrosilex, structured in lodes and dykes, from the department of Montevideo.

104 *Granite Gneiss,* from Montevideo.

105 *Porphyric Sienite,* mephitic appearance, from the department of Montevideo.

106 *Ancient Green Labradophile Porphyry,* from Isla de Flores, in the department of Montevideo.

9th variety.

Number 107 *Porphyric Phonolithe*, light green colour (variety of Basalt), from the department of Maldonado.

2nd sub-variety.

108 *Slate Phonolithe* (variety of Basalt), from the department of Florida.

TRACHYTE.

109 *Porphyric Trachyte*, from the department of Maldonado.

GENUS-HYDRATE ALUMINOUS SILICATES, WITH ALKALIS AND THEIR ISOMORPHS.

15TH SPECIES—ANALCIME.

110 *Analcime* (Hydrated Silicate of Alumina and Sodium), from the department of Cerro Largo.

111 *Lithomarne.*

20TH SPECIES—PAGODITE.

1st variety.

112 *Soapstone* (Saponite), from the department of Minas.

GENUS NON-ALUMINOUS SILICATES.

4TH SPECIES—TALC.

113 *Talc*, from the department of Rocha.

113*a* *Talcose Slate*, from the department of Rocha.

5TH SPECIES.

114 *Silicic Steatite*, with Pyrite of Magnetic Iron, from the department of Maldonado.

6TH SPECIES—SERPENTINE.

115 *Serpentine*, from the department of Colonai.

116 *Amygdaloid Variolite*, Clayey Porphyry (specific gravity 2·50), from the department of Montevideo.

117 *Diorite*, from the department of Montevideo. This rock, Green Porphyry Labrador, Basalt and Quartz, are abundant in the Territory of the Republic.

17th SPECIES—PYROXENE.

Number 118 *Pyroxene*, from the department of Minas.

119 *Pyroxene Basalt* (specific gravity 3·40), from the department of Montevideo.

119*a* *Escoriform Basalt*, from the department of Montevideo.

GENUS FLUATE SILICAS.

1st SPECIES.

120 *Cryolite*, from the department of Florida.

3rd SPECIES.

121 *Yellow Mica* (Micacite), from the department of Minas.

122 *Gray-green Mica*, from the department of Montevideo.

123 *Common Mica*, from the department of Minas.

GENUS SILICIC BORATES.

2nd SPECIES.

124 *Turmaline*, enclosed in Quartz and Feldspar (Porphyroid Granite), from the department of Rocha.

GENUS SILICA OR QUARTZ.

1st SUB-SPECIES.

125 *Hyalin Quartz or Rock Crystal* (isolated crystals), from the department of Rocha.

126 *Hyalin Quartz*, from the department of San Jose.

127 *Amethyst Quartz*, from the department of Rocha.

128 *Venturine*, from the department of Maldonado.

129 *Anhydrous Calcedony of Spherical Texture* (conglomerated Silica), with inner cavity filled with crystals of Silica, in the form of Stalactite, from the department of Durazno.

2nd SUB-SPECIES—LITHOID QUARTZ.

130 *Anhydrous Calcedony* (Conglomerated Silica), of botroidal texture, with isolated points of Silica in its inner cavity, from the department of Durazno.

2nd *variety of* AGATE QUARTZ—COARSE AGATE QUARTZ.

Number 131 *Blood-coloured Jasper* (Blood-stone), from the department of Cerro-Largo, Acegua Mountain.

132 *Basanite* (Touch-stone or Lydian-stone), from the department of Florida.

133 *Horn-stone* (specific gravity 2·40), Silica and Silicate of Potash, from the department of Maldonado.

3rd SUB-SPECIES—AGATE QUARTZ. 1st *variety*—PEARL-SINTER.

5th *sub-variety.*

134 *Quartz Calcedony,* from the department of Soriano.

4th SUB-SPECIES—AGATE QUARTZ—SILEX—GUN FLINT.

1st *variety.*

135 *Pyromaceous Quartz,* Gun Flint, from the department of Soriano.

136 *Silicious Nodules,* Gun Flint, from the department of Soriano.

2nd *variety.*

137 *Molena,* Cavernous Quartz, containing Creta, from the department of Soriano.

6th SUB-SPECIES—RESINITE QUARTZ—OPAL—PAEDERUS.

3rd *variety.*

138 *Ligneous Opal,* Opalized Wood, from the department of San José.

139 *Gilopal,* resembling Staghorn, from the department of Cerro-Largo.

5th *variety.*

140 *Geiserite,* Thermogene Silex, from the department of Salto.

8th *variety.*

141 *Lithogene or Petrified Wood,* from the department of Salto.

GENUS BARYTA.

3rd SPECIES.

142 *Sulphurated Baryta* on Calcareous Spar, from the department of Maldonado.

GENUS LIME.

1st *variety.*

Number 143 *Compact White Limestone,* with Pyrites of Sulphuret of Iron, from the department of Cerro-Largo.

144 *Fibrous Limestone* (specific gravity 2·50), hardness 3, fibrous testaceous texture, from the department of Cerro-Largo.

2nd *variety.*

145 *White Limestone,* Saline Marble, from the department of Minas.

146 *Fibrous White Marble.* This contains like the last Carbonate of Lime, a small quantity of Sulphate of Lime, and a very little Silic; it is used in Architecture for making Lime, in Agriculture, and for other purposes; from the department of Maldonado.

147 *Sub-variety of Pentelic Marble,* from the department of Maldonado, and the quarry of Colonel Gervasio Burgueño.

148 *Sub-variety of Pentelic Marble,* alabaster-white colour with reddish stripes, from the department of Maldonado. Colonel Gervase Burgueño's Quarry.

149 *Sub-variety of ruiniform Marble,* colour white with alternating lines of dark red and lighter red, from the department of Maldonado. Colonel Burgueño's Quarry.

150 *Sub-variety of Red Antique Marble,* from the department of Maldonado. Colonel Burgueño's Quarry.

151 *Limestone with Fossil Shells, variety Coarse Limestone,* from the department of Colonia, New Palmyra. Messrs. Belgrano's "Chacra" (Habitation).

152 *White Silicic Marble* (specific gravity 2·70), *Sonorous Limestone,* from the department of Canelones, Solis Grande.

153 *Incrusting Limestone* (specific gravity 2·70), from the department of Florida.

3rd *variety of* Limestones.

154 *Lithographic Stone,* from the department of Soriano.

10th *variety.*

155 *Marls with Dendrites of Manganese.* Hydraulic slaty Lime compact, from the department of Paysandú.

2nd SPECIES—ARAGONITE.

Number 156 *Aragonite.* Carbonated, prismatic, fibrous, hard salt; Concreted Limestone (specific gravity 2·80), from the department of Cerro-Largo.

3rd SPECIES OF LIME.

157 *Crystallised Dolomite,* on compact Dolomite, granular, grey (specific gravity 2·80), from the department of Florida.

158 *Aluminous-ferruginous-crystallised Dolomite,* colour dark yellow, is composed of Carbonates of Lime and Magnesia, Alumina and Oxide of Iron, from the department of Cerro-Largo.

159 *Compact White Dolomite* (specific gravity 2·80), from the department of Florida.

160 *Dolomite with Black Jasper.* Dolomite in brecia, from the department of Florida.

FOSSILS.

The specimen marked No. 97 is a Clay Slate containing fossil impressions of *Annularia longifolia.*

Number 161 *Orthoceratites regularis,* converted into calcareous stone; department of Maldonado.

162 *Fossil leaves of Odontoperis Schlotheimi,* converted into compact sulphurated iron pyrite, enclosed in asperons of carboniferous gravels; from the department of Cerro-Largo.

163 *Impressions of fossil leaves of Odontoperis Schlotheimi,* in compact sulphurated iron pyrite; from the carboniferous land of Cerro-Largo.

164 *Impressions of fossil sprouts and leaves of Nevropteris speciosa,* on compact sulphurated iron pyrite and cohesive gravel; from the carboniferous land of the department of Cerro-Largo.

165 *Fossil Trunk of Nevropteris speciosa,* converted into compact sulphurated iron pyrite and cohesive gravels; from the carboniferous land of the East of the Republic, department of Cerro-Largo.

CLEMENTE BARRIAL POSADA.

Montevideo, 6th March, 1882.

ANNEX NUMBER 1

TO THE WORK ENTITLED

ORIGIN OF THE AURIFEROUS REGION OF TACUAREMBÓ,

ITS ANALOGY AND CONCORDANCE

WITH

OTHERS OF THE AMERICAN CONTINENT.

ORIENTAL REPUBLIC OF URUGUAY.

SOUTH AMERICA.

GEOLOGICAL STUDY
OF THE
AURIFEROUS REGION
OF
TACUAREMBÓ
WHICH INCLUDES
THE DISTRICTS OF YAGUARI, LOS CORRALES, AND CUÑAPIRÚ.

AWARDED A DIPLOMA OF HONOURABLE MENTION AT THE
UNIVERSAL EXHIBITION OF PARIS, 1878;
AND AWARDED THE GOLD MEDAL AT THE AMERICAN
CONTINENTAL EXHIBITION OF 1882 AT BUENOS AIRES.

SECOND EDITION:

BY ORDER OF THE GOVERNMENT OF URUGUAY.

4TH FEBRUARY, 1888.

GEOLOGICAL STUDY

OF THE

AURIFEROUS REGION OF TACUAREMBÓ,

WHICH COMPRISES THE

DISTRICTS OF YAGUARI, LOR CORRALES & CUÑAPIRÚ,

CHAPTER I.

Cause, Origin, Georographical and Astronomical Position of this Region.

The mineralogical centre of the Auriferous Region of Tacuarembó is formed by the Cordillera of *Santa Ana,* which runs E. 32° 30′ S., and towards the N.N.E. of the Cordillera of *Haedo.* The extent of this range within the Republic is 128 kilometres, equal in length to that of its frontier, at this point, with Brazil, to which country the remainder belongs. Its average height is 490 metres above the level of the sea, and its slopes trend towards the Department of Tacuarembó, the one in this Republic, and the other towards Brazil.

These ranges join together and form the Knot of Santa Ana, which is situate 30° 52′ 18″ south latitude, and 49° 31′ 2″ west longitude from the Meridian of San Fernando.

CHAPTER II.

Georographic Report on the Mineralogical Centre, its origin and extent.

The Cordillera of *Santa Ana* is a ramification of the *System of Mountains of the Andes,* &c., which stretches from the Straits of Magellan, and reaches to beyond the 55° of north latitude. The sub-system of the Uruguayan Mountains runs from the range of the Andes to the west of Chuquisaca, from whence it begins to form considerable windings. This SUB-SYSTEM, which we shall hereinafter call the *Gran Ramal* (Great Chain), divides to the south and north the waters of the following rivers: to the north the rivers Madeira, Tapajóz and Xingú, tributaries of the Amazon, the rivers Uruguay and Tocantins, confluents, the former of the latter, and the latter of the river Pará towards the north.

The Gran Ramal forms the heights of *Matto-Grosso*, extends towards the E.S.E., gives rise to the rivers of the south, the *Paraguay* and the *Parana* on opposite sides, the former of which joins the latter in the Province of Corrientes (Argentine Republic), and afterwards in latitude 34°, the *Uruguay* and the *Parana* unite and form the estuary of La Plata, which falls into the Atlantic Ocean to the south, the Amazon and the Pará to the north.

The Gran Ramal extends to the *Pyrenees* mountains of Brazil to the east of Villa Boa or Goyaz, where it separates into two branches; one sub-chain trends to the N.N.E., and reaches as far as the 3° south latitude at Paranahyba and feeds the rivers *Piauhy, Jaguaribe* and *San Francisco,* which discharge into the Atlantic.

From the *Pyrenees* mountains this chain turns towards the S.S.E., give rise to the river San Francisco, and passes to the west of the City of Rio Janeiro, feeds the rivers Paranahyba and Yguapé crosses the provinces of San Paulo, Paranagua and Santa Cathariña, and becomes the source of the Rio Uruguay, passes through the province of the Rio Grande do Sul, then feeds on opposite sides the rivers Pardo, Ibicuy-gunsú, Camacuám, Piratinim, Yaguaron and Rio Negro; it then enters this Republic, furnishes water on opposite sides to the rivers Tacuari, Olimár, Cebollati, Yi and Santa Lucia, and reaches at length the City of Montevideo.

Within the Republic it separate into four chains or sub-ranges which are called Cordilleras, *Grande, Haedo, Minas* and *Santa Ana.*

This Gran Ramal, throughout its whole extent, upheaved and stratified the lands of various geological periods, and in the districts of "Yaguari," "Les Corrales," and "Cu apirú," laid bare the materials of the "Silurian" group (lower bed).

CHAPTER III.

ANALOGY BETWEEN THE AURIFEROUS REGIONS OF THE AMERICAN CONTINENT. SAME ORIGIN.

Although, in itself, the fact of the *upheaval of the system of Mountains of the Andes, &c.,* may not be the origin of all the *igneous metallic arteries* of the region of Tacuarembó, Camacuám, San Paulo, Minas-Geraes, Matto-Grosso, &c., and those of the Chain of the Andes proper and its flanks, belonging to the

Argentine Republic, Chili, Bolivia, and lastly, to California; still there is reason to believe that there is identity in the Ore of them all, that their origin and time of appearance are the same, and the resemblance extends to their georographic aspect. If we consider, moreover, that the fossils met with in the said regions belong to the same epoch, that the character of the igneous metallic craters does not differ, and that on the other hand, the nature of the materials in contact is of the same period, we shall be compelled to acknowledge that if the excellence of the metal in one of these regions be granted, or in other words, if the presence of native Gold be admitted, in sufficient proportion to allow of its payable working, in *California* and *Minas Geraes*, there can be no reason to suppose that the region of Tacuarembó would not offer the same advantages.

In the auriferous regions of Tacuarembó, Camacuám, San Paulo, Minas Geraes, Matto-Grosso, and California, the Silurian formation (lower bed) is perfectly well defined, and a portion of it has been upheaved and stratified by igneous-metallic arteries, the matrix of which is composed of ferruginous clay-slate. It must also be noted that although the talcose and chlorite slates (green slates) are abundant in these countries they never form a frame for the seams of auriferous quartz, but for the micaceous amphibole, and other more recent igneous rocks, dioritic and porphyry-dioritic, which sometimes intercalate small veins, and even veins of quartz.

But Diorite, like the Porphyry-Diorite, is present in the regions referred to, in the form of dykes and seams of a certain thickness although of small extent, and hence it is easy to distinguish the folding of the beds, more or less marked, according as the distance from another artery, whether of Diorite, Amphibole, or Quartz, is the greater or less. When the arteries are near together, the folding is replaced by the fracture of the beds, and their non-conformity.

It must at the same time be taken into consideration, that independently of the non-conformity in stratification of the greater part of these lands, the whole of the rocks are characterised by their colours, viz., reddish-mahogany, yellowish-red, green, dark green and brown, with the exception of the Quartz in some of the arteries.

The Devonian land forms small isolated zones in these regions, whereas the Carboniferous, characterised also by its fossils (impressions of *Annularia longifolia* and of *Odontopteris Schlotheimi* in the clay-slates, in the slaty clay and in the sandy conglomerates), approaches those of Tacuarembó (in this Republic), Camacuám, Matto-Grosso (Brazil), and that of San Juan (Argentine Republic); in which it is independent in its own soil; and both in Tacuarembó as well as in the other regions, it is partly stratified by Diorite, Quartz, and especially by Green Porphyry (Porphyr-verde-antico), the rocks of which metamorphosed the materials in contact and adjoining, for a short distance.

Lignite, which is very apparent on the surface of the land in the districts of Candiota, Piratinim, and the Rincon del Infiernillo (S.E. and E. extremities of the region of Camacuám), proves that it has undergone the igneous action of above-mentioned rocks, inasmuch as the beds alongside of the said arteries do not show the horizontal position which they retain in the major part of these formations, but are dislocated, and dip, according to their situation, at an angle of inclination up to 60°. Moreover, it may be held as an incontestable fact that the small veins of Quartz forming the matrix for Sulphurated-iron-pyrites, intersect, in certain spots, the layers of Slaty-clay and Coal, converted into Anthracite, in which, moreover, Sulphur is visible, in the form of thin flakes.

CHAPTER IV.

PALÆONTOLOGICAL AND PETROGRAPHIC RELATIONSHIP BETWEEN THE AURIFEROUS REGIONS OF AMERICA.

The materials in Tacuarembó, Camacuám, San Paulo, Minas Geraes, Matto-Grosso, and California are the same; they show the same origin and the same age; their origin is igneous, represented by eruptive Quartz in veins and seams, serving as a matrix for Gold in common with other metals.

The age dates from the lower Silurian (Palæozoic period), represented by the following materials :—*Talcose-slates, Siliceous-micaceous Slates, layers of Quartzite ferruginous-brescias, beds of ferruginous Sand,* of tabular structure and oblique position, in some parts keel-like in formation, and in other parts in leaflets; of sandy texture and rough to the touch, and in colour deep red, light red, yellow in parts and whitish in others, and calcareous Dolomites.

Chlorite Slates of slight consistency are found forming small zones, and also of a light red colour, alternating with gravels of the same colour; these are in some parts greenish and show a texture in consistent masses. I did not find any fossils in the materials of these zones, though I did in the former, that is to say, only in the ferruginous clay-slates, but not in the immediate vicinity, but somewhat distant. In these slates I met with the fossils of the *Conocephalites sulzeri* and of the Paradoxides pradoamus.

The sedimentary beds are stratified by *eruptive Quartz,* and also by *micaceous amphibole,* Green porphyry (Porphyry verde-antico), Dioritic porphyry, and Diorite, which intersect, in some parts, the veins and igneous small veins of the former, and substratify the sedimentary beds.

CHAPTER V.

GEOROGRAPHY OR OROGRAPHIC GEOGRAPHY OF THE DISTRICTS OF YAGUARI, CORRALES, AND CUÑAPIRÚ.

Branches proceeding from the Cordilleras of Haedo and Santa Ana.*

1st. At 72 kilometres, to the east of Santa Ana, is situate the Ramal of *Yaguari* or *Araycuá*, running S. 25° W., length 105 kilometres.

Starting from the Cordillera of Santa Ana, between the sources of the rivers "Corrales" and "Yaguari," it comes to an end at the confluence of this latter stream with the river Tacuarembó.

This Branch, in its extension, produces three bends, that is, two to the E., the third, situate at the centre, trends to the W., and the average deviation from the straight line is five kilometres. From the inflected extremity of the centre, the plateau of Araycuá detaches itself, the elevation of which is 262 metres above the level of its base.

2nd. At 50 kilometres the branch of the Corrales is situate, direction S. 25° W., length 79 kilometres. It starts from the Cordillera of Santa Ana, between the sources of the river Corrales and the streamlet of Bentos Correa (tributary of the river Cuñapirú), and terminates between the confluence of this latter river and that of Corrales.

This branch runs in a straight line and at its extremity almost joins on to the Cuñapirú branch, with which it forms an acute angle.

3rd. At 30 kilometres is the branch of Batobi, direction S. 15° W., length 39 kilometres. It starts from the above-named Cordillera between the sources of the Batobi river and those of the river Cuñapirú, and disappears at the confluence of these two rivers. This branch extends almost in a straight line, for although it forms a bend in the centre it only deviates from the straight by one kilometre. At the spot where this chain begins is situate the table land of *Chapeu* which is 268 metres above the level of the ground.

To the S.E. at a distance of 2½ kilometres is the table land of Trinidad, the altitude of which is somewhat less than that of the preceding.

At 8 kilometres distance more or less from the last, and upon the same branch, stands the hill of *Chato-Dorado*; its height is 343 metres above the level of the ground.

The altitude of the Peak of Santa Ana is 537 metres above the level of the sea.

The most elevated point in the Department of Tacuarembó is that of the *Bichadero* mountain, 658 metres above the level of the sea. I took this altitude, as I did the others, with an aneroid barometer.

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* While noting here the respective distances of each branch, we shall give before the name of each of them their distance from the Peak of Santa Ana.

4th, at 15 kilometres to the S.S.W. of the Knot of Santa Ana is situate the chain of Cuñapirú, direction S. 7° W., length 100 kilometres. It starts from the Cordillera of Haedo, betweon the sources of the river Tacuarembó and those of Cuñapirú, forms some bends in its course, and ends at the confluence of the river Cuñapirú with that of *los Corrales*.

This chain extends almost in a straight line, if we except the first bend, which immediately after starting from the Cordillera begins to be defined towards the east, and extends for a distance of 42 kilometres, deviating 7 kilometres from the straight line. The other bends may be said to be of little importance. A few sub-chains and strikes spring from the preceding branches, but none are detached from them, excepting the strikes,* which by their relatively limited extent, can scarcely be placed in this category; but this is not the case with the reefs of secondary order alluded to, the strikes which spring therefrom on both flanks to the number of 300 to 400 being divided and sub-divided in succession, some of them winding, and others in a straight line. These latter in their turn form small hills, ledges and table lands, and at length this chain establishes one of the most varied georographic systems, the whole of which is interesting to its very end, in which various table lands, and among these the miscalled hills of Cuñapirú, present themselves at a distance of 16 leagues from this chain. They are perceived from the summit of "los Tambores," situated in the Cordillero of Haedo.

CHAPTER VI.

Hydrography, Climate and Aspect of the Region.

The preceding georographic description leads us to refer to the existence of virgin forests, which in the form of belts stretching along both banks of the rivers, follow them along their course; as they also do with the river Tacuarembó, of which all the rivers are tributaries: the average width of each belt of trees is 300 metres. This fringe, forming a frame on the banks of these rivers, which flow at the foot of the georographic declivities, beautify them exceedingly, and bestow on them a peculiar attraction and charm, and contribute to the embellishment of the entire region, which is enhanced by a pure, clear, and smiling sky, in perfect harmony with its temperate and healthy climate, free from marshes and stagnant pools of water, which might taint the salubrity of the region, the georographic consideration of which here comes to an end.

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* "Estrigas," a Latin word equal to step or buttress in Geology; loam or stiff clay.

CHAPTER VII.

Industrial Geology.

It has been said in Chapter II. that the "mineralogical axis" of the auriferous region of Tacuarembó—which comprises the districts of Yaguari, los Corrales, and Cuñapirú, where are situate the chains mentioned in Chapter V.—is the Cordillera of Santa Ana, and a part of that of Haedo, &c.

From these chains are derived *the igneous arteries of Quartz, in seams, veins, and small veins,* in which *Gold* and *other metals* are contained, and the arteries of which extend, some at a right angle, others at an acute angle, and take opposite directions to that of the "axis," from which they emanate in such a manner that, if we may be allowed the comparison, these seams and veins are to the branch chains what the ribs are to the vertebral column.

Some seams are subdivided into veins which take different directions, and some of which are without any regular form; for although several run in a straight line, others are winding, present notable bends and considerable depressions, and very often seem to be broken at their projecting extremity; but these interruptions are only apparent, for in the works undertaken at Cuñapirú and Corrales, the contrary has been seen, that is say, that in these works, executed to a depth of 18 metres, the veins present unbroken continuity, and what occurs at the surface in some of them is not a break or interruption, but only depressions, to which the vegetable bed serves as a covering, thus at first preventing their continuity from being seen.

The presence of a hillock, a hill, or an isolated plateau (or table land), indicates the existence of a *vein of quartz,* generally non-metallic; a "dyke" is announced by a plateau (or table land), a hill, or a mound. Every sub-range denotes the existence of a seam; every *strike* that of several veins near to each other, and parallel in some places; but in others they take distinct directions, in which case they intersect each other and interlace through their small veins, &c., form a network, and alter their directions in the same, so as occasionally to lead astray an inexperienced observer. It must, however, be noted that the veins especially do not dip with an inclination of 90°, but obliquely, varying from 85°, 70°, and even in some to 60°; but they do not all dip towards the same point, but nevertheless they do not fail to prove in some places that they join together at a certain depth, chiefly in those cases in which their directions keep parallel, as in the mines called "San Pablo," in Cuñapirú, in which the veins mark a dip tending to form an acute angle, the apex of which may, perhaps, be at a depth of sixty metres, more or less; but in other cases and in other places, the junction does not certainly take place under a depth of 120 and even 200 metres, as the declivity of some parallel veins in the district of Yaguari appears to prove.

CHAPTER VIII.

TWO SPECIES OF ERUPTIVE QUARTZ, COMPRISING 4 VARIETIES AND 1 SUB-VARIETY, IN THE AURIFEROUS REGION OF TACUAREMBÓ.

Some arteries of Quartz contain Gold and different metals, others have no other metal but Oxide of Iron, which gives them a faint and partial colouring.

1st SPECIES.—NON-METALLIC QUARTZ.

1*st Variety.*

Vitreous-hyalin-quartz in seams and veins, with a semi-oval texture, in the emerging extremities, and in a hard and compact mass; when struck with a hammer, it breaks into flakes instead of large fragments.

This Quartz alternates in certain localities with auriferous quartz, and what is stranger still, these two varieties seem to intercalate together and form below the soil a common vertex.

2*nd Variety.*

The milky white Quartz structured in dykes and ladder-shaped seams, and moreover as it were quartered, presents apparently crossed planes; but this is not so, and it is to be remarked that this doubtful *fac-simile* does not dip below the emerging extremities. Its compact, hard, but untenacious texture breaks under the blow of a hammer without flaking. This variety is found at Cuñapirú, forming a dyke of 12 kilometres in length, which trends from E. to W.

This Quartz exists also in the districts of Yaguari, and in that locality, although of the same structure and texture, etc., is more abundant, for it not only forms hills, mounds and strikes, but also crowns the crest of a part of the Cordillera of Haedo, and the whole of that of Santa Ana as far as its eastern extremity in the Republic, where it forms the plateaux called "La Cerradilla," and at 19 kilometres to the S. the hills "Blancos" and "Hospital"; so that it may be considered the mineralogical "Axis of this Region."

This Quartz is somewhat elastic; this quality is ascertained when it is broken to pieces with the hammer; and it is rare in the latter case, if the faces of the fracture are not irregular and the points broken by the blow adhering to the mass, from which they cannot always be separated by the fingers, nor sometimes even with the blade of a pen-knife.

Perhaps further explorations may lead to the discovery of the Gold contained in these varieties of Quartz, which they have not yet succeeded in doing, neither in the region of Tacuarembó nor in those others in which it exists under a like form and structure.

2nd SPECIES.—METALLIC QUARTZ.

1st Variety.

The white alabaster Quartz structured in seams, veins, and small veins, of massive texture, compact, porous, hard, and tenacious; on being struck with the hammer it breaks into small angular fragments, rather blunt and with few points. With regard to colour, the alabaster white predominates, although at certain fixed points it is found to be replaced by plain white, dirty white, a greyish greenish white, and a whitish alabaster faint sky blue; this latter colour, which is marked by its waxy appearance, is the one which presents most pores; it must, moreover, be observed that, of these latter, those which are not filled with Oxide of Iron receive at least a tint; but there are some also which contain Gold.

I did not find in this region, nor in the auriferous regions previously mentioned, any variety of dull white Quartz.

It is right to remark that this Quartz (2nd species, 1st variety) is the most richly stocked with Gold in the whole region. Specimens bear the Nos. 1, 2, 3, 4.

UNIQUE SUB-VARIETY.

Quartz, almost the same as the above, with the difference of being a little more hyaline; structured in veins and in texture a compact mass, hard but not tenacious. This quartz likewise serves as a matrix for Gold, but the proportions in which it presents itself are inferior to those of the preceding Quartz. Sulphurated Pyrite of Copper, Carbonate of Copper (Malachite), and some crystals of Argentiferous Galena are the metals which one finds associated with Gold in this sub-variety of Quartz which lies at Cuñapirú, at the Southern extremity of San Pablo, with the arteries of which it alternates, and also in the district of Los Corrales.

2nd variety.

Vitreous-smoky Quartz, and also *Vitreous-Alabaster-white Quartz,* partly belonging to the same rock, structured in veins and small veins; its texture a compact mass, hard, but wanting in tenacity; it falls into pretty large blocks under the hammer; the fracture is somewhat scaly, and the points, although salient and with a sharp edge, are, however, not equal to the 1st variety of the 1st species.

This Quartz contains a very small quantity of Gold, a good deal of Oxide of Iron, and Black Iron Pyrites; it may be that these two metals are the only ones which are contained in this work. At rare intervals traces of Carbonate of Copper and Sulphurated Iron Pyrites are wont to show themselves, but in so small a quantity that they are of no importance.

The seams and veins of eruptive, which form the second species, contain the metals already mentioned, but the small veins are without them, and if perchance they do contain a few they are generally Gold, Oxide of Iron, and Sulphurated Iron Pyrite.

CHAPTER IX.

Recognised Area of the Auriferous Region of Tacuarembó.

This region comprises an area of 340 square leagues as ascertained up to the present, in which the above-mentioned igneous veins of Quartz are well marked, and in their directions some keep their parallelism, others cross each other, and others terminate at one point, and together form a net-work in various localities.

And although the metalliferous Quartzes, or those of the second species, may differ in colour, texture, etc., I consider them nevertheless to be of contemporaneous origin and simultaneous appearance, particularly those of the 1st variety.

The Quartzes of the first species, referred to in Chapter II, appear to be more modern, inasmuch as they cross those of the second, and their thickness and orographic relief are greater.

CHAPTER X.

Three Igneous-metallic Bodies.

1st Division.

The Alabaster White Quartz (2nd Species, 1st variety) serves as a matrix for the Gold, which it contains in the form of threads, nuts, sheets, and small nodules, sometimes filling the porosities of the Quartz.

In company with the Gold are found *Carbonate of Copper, Sulphurated Pyrite of Copper, Argentiferous Galena* in small thin crystals, *Red Oxide of Iron* and *Sulphurated Iron Pyrite*; but the latter is not common to all the veins of the 1st variety of

Quartz, and it must be stated that this Sulphurated Iron is more abundant at the surface than at the interior, contrary to Malachite, which from about 8 metres below the soil, increases in quantity in certain veins, and accompanies others from the surface; but in this case the Malachite diminishes the deeper one goes. It has also been observed that the Galena diminishes in some veins in proportion to the depth, while the contrary is the case in others.

With regard to the Gold, it may be said as a general rule, that it is more abundant at the emergent extremities of the veins, and down to an average depth of 4 metres (Specimens marked No. 2) collected from the surface of the mine of San Pablo in Cuñapirú; but further on it is found distributed in the said Quartz with a certain regularity, in the proportions stated in Chapter XI, but it must be noted that the superior class (Specimens marked No. 4, obtained at a depth of 15 metres in the said mine of San Pablo in Cuñapirú) is not abundant; for only half a ton can be got from a 100 tons, or in other words, it represents ½ per cent. in the richest veins, and the remaining 99½ tons may be classified as follows:—20 per cent. of Ore of the 1st class; 50 per cent of the 2nd, and 29½ per cent more or less of the 3rd class.

Consequently, if the Quartz is worked as a whole and without classification, it will yield at the rate of three ounces of Gold per ton, approximately, or what is the same, 86 grammes 13 centigrammes per 918 kilogrammes 880 grammes. From the Galena some Silver is obtained, but in the face of the small quantity and its accidental presence in these veins of auriferous Quartz, its existence is stated, as well as that of Carbonate of Copper and Iron, more on account of its connection with the Gold than for any importance—which is almost null—it possesses in an industrial point of view.

CHAPTER XI.

As already stated, Gold is present in 170 veins of igneous origin of Quartz, approximately, which I examined in this region of Tacuarembó, and among which, some in which shafts have been sunk, have been examined by me from their emergent extremities down to a depth of eighteen metres, the works being carried on for several months in succession, during which, in addition to the assays previously made of Ores from distinct points of the region, I made several others of Ores taken from the surface down to the depth already mentioned of eighteen metres, in order to ascertain, with all possible accuracy, the average yield of Gold contained in the Quartzes.

I further observed other facts, which, as I consider them of interest, I noted down and now proceed to mention:

1st. That the vein of Quartz which contains Gold in the interior or deep down, shows it at the surface or emergent extremity; if not, all attempts to get it are useless.

2nd. That the dykes do not contain Gold, and as to the seams,* is only occasionally found in some, and in very small quantity; the independent veins and small veins, and even some of those derived from the dykes and seams contain Gold, and are therefore worth working, as is proved by the specimens, Nos. 1 to 4 inclusive.

3rd. That for the better success of the explorations tending to the discovery of auriferous Quartz, the presence of veins coloured with Oxide of Iron, of a mahogany colour and a light chestnut, is essential for the purpose, for it is rare that such a vein does not contain it.

4th. That the arteries (large veins) of Quartz, with Oxide of Iron at the emergent extremities, have their interstices and inner mass, down to the depth examined, also coloured by it, as if it had cropped up along with it and been its necessary attendant.

5th. That Gold is more abundant in the above-mentioned arteries, when, besides having the colour indicated, the mass of the texture is of a porous-cavernous nature, similar to common cork in its interior; it being observable also that this Quartz is very generally constituted in veins and small veins.

6th. That the Gold is more abundant in the emergent extremities of the veins to a depth of about 4 metres, than deeper down, except in cases where the veins cross each other, and in those in which the Quartz presents less hardness and resistance to the tools employed.

7th. That the presence of *plastic-clay* in the interstices of the Quartz, which it fills up, as well as sometimes a kind of horizontal caverns, which appear to be plains of jointure, is an undoubted token that the Quartz contains a notable quantity of Gold.

8th. That the walls of the lode accompany only a small number of veins of auriferous Quartz, and even then only partially.

The veins and small veins especially being connected by their vertical and horizontal direction with the frames (Specimen No. 6), which proves the igneous fusion of the Quartz when upheaved to the surface, which simultaneously with the subterranean beds composed of crystallised and ferruginous-clayey materials, it upheaved, stratified, metamorphosed exceedingly and broke up in various directions, the said Quartz irradiating, moreover, through the crevices and spreading in large veins of varying lengths and thicknesses.

Now, the origin of Quartz being distinct from that of Iron, their association causes surprise; but it is a fact, that the latter does exist in the former without break of continuity, and that its presence is more clearly revealed in the veins which contain

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* I refer to the veins of vitreous quartz, in which it is rare to find any Gold, but it is not so in the veins of Milky White Quartz, Alabaster White, Ferruginous Aluminous White, which contains Gold, whether in tifons, dykes or lodes.

Gold, which does not seem easy of explanation, considering the principle that Quartz proceeds from the central igneous mass, which solely contains *Gold*, *Copper*, *Galena*, etc., and no Iron.

The presence of Iron in the Quartz may be otherwise explained, but it is to be considered in this case as being added to the said rock on its upheaval through materials saturated with it, which, if that be so, could not possibly maintain co-relation with the Gold, and would rather render doubly surprising the coincidence that in this *Quartz the matrix of the Gold*, Oxide of Iron should be infallibly associated with it.

Likewise, the presence of Oxide of Iron in the Quartz may be explained by the superabundance of the same in the envelopments, which, raised and broken by the said Quartz on its upheaval in a state of fusion, became impregnated with this Oxide, which seems to be proved by the fact that some veins of Quartz, rich in Gold, as for instance those of the mine of San Rafael, and others in the district of Los Corrales, are for the most part of white alabaster colour, which coincides with the rarity of Oxide of Iron in their envelopments; but, on the other hand, it is observable that Sulphurated Iron Pyrite exists in the Quartz.

But still more extraordinary than what precedes, is the fact that Silicated Hydrate of Alumina deposited in the interstices and cavities of the veins of Quartz of igneous origin, which fact appears accidental, coincides precisely with the great concentration of Gold in the same point, which does not occur generally in the vein, except in the case of intersection, and the others previously alluded to.

The presence of this clay in the midst of the Quartz is explained by the decomposition of the envelopments, the effect of the waters percolating through the interstices of stratification, and which they both carried to and filled up the crevices of the interior of the Quartz, etc. But what is not easily explicable, is that whilst there is not the most remote analogy between these elements, they show themselves in forced association, and proclaim themselves, as is the case with Plastic Clay in respect to Quartz, when the latter contains Gold.

And yet the fact in question is so positive and so universal, that it can be asserted that the presence of the said Silicated Hydrate of Alumina in the Quartz, is in mining operations, even to the workmen, a sure sign of the abundance of Gold in the Quartz.

I have seen (in this region, in various veins of auriferous Quartz, where the clay has filled up the crevices and cavities) large pieces of gangue, rich in Gold, torn out with the borer, and small prices in which this metal was of greater weight than the Quartz (specimen No. 1, taken at a depth of twelve metres, in the mine of San Pablo, in Cuñapirú), and fragments of the said gangue or quartz, of about 100 cubic centimetres, which have yielded from two to five ounces of Gold.

Oxide of Iron colours the greater part of the rocks and soils, and is present, as has been already stated, in the igneons veins of Quartz of the 2nd species, offering thereby, it may be safely said, a sure indication of existence of Gold. Moreover, Gold lies in this region, as it does in "Matto-Grosso," "Minas-Geraes," Encrnsilhada * and California, acting, as it may be said, as an advanced sentinel in the emergent extremities to some veins of Quartz; but it must be noted that from the surface downwards, and in some more than in others, Gold is found in partial association, not only with Oxide of Iron, but with Malachite. White is diffused and contained in the mass of Quartz or Gangue, sometimes to a greater extent, so that in some veins it exceeds the Gold in incomparable proportions, and in these cases it is not unusual to find *Azurite* and Copper Pyrite, those these latter are in smaller quantities, all associated in the same gangue; but it must be borne in mind that although these metals are in association, they are *not* amalgamated with the Gold.

There are also veins in which the Gold is only associated with Oxide of Iron, traces of Malachite, rare crystals of Galena, and traces of Platina. These veins are the ones which form the mines of "San Gregorio," "San Rafael" and "Apollo," in the district of Cuñapirú, and others in that of Yaguari.

2nd *Division.*

DOUBTFUL SUB-VARIETY OF QUARTZ, ETC.

Quartz, white-alabaster colour, more resembling *hyalin* than the above: structnred in veins and of solid massive texture; but the said veins are isolated and do not appear to converge towards those of the 1st division.

The Gold in it is less abundant, and, contrary to the preceding, it is more charged with Copper, in the form of Carbonate and Sulphur and argentiferous Galena.

The localities where this "Second Metallic Association" is found are the district of *Yaguari,* that of *los Corrales,* the Mine of Castrillon and the district of Cuñapirú, at the southern extremity of the hill in which are the workings of the Mine of *San Pablo.*

3rd *Division.—Metallic.*

EXISTING IN THE SECOND VARIETY OF QUARTZ, VIZ., SMOKY VITREOUS QUARTZ AND ALSO IN THE VITREOUS-ALABASTER QUARTZ.

Structured in veins, textnre a compact mass, hard but not tenacious. This Quartz forms a matrix for the metals of the 3rd *Division,* and is distinguishable by its intense smoky colour, that is to say, that Black Oxide of Iron and Black Pyrite of Iron of various sizes interlace and form groups, which in some parts present the appearance of Hematite Iron, without being so. In others they resemble Oxidised Iron with magnetic properties, but yet not forming positive poles. This Iron is identified with Quartz to such an extent that they have more the appearance of having originally amalgamated, than the consequence of an aggregation posterior to the 2nd and the 1st.

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* The regions of Matto-Grosso, Minas-Geraes, and Encrusilhada belong to the empire of Brazil.

† By the term emergent extremities of the veins, I designate the head or crest which shows itself at the surface of the land, that is to say, the summit or crest of the dykes, lodes, veins and small veins of Quartz.

But however this may be, whether these two bodies were originally amalgamated or not, it is a fact that Gold is met with in the form of nuts sometimes, but generally in sheets, spangles and fibres, which nevertheless are present in the interior of the rock.

The Sulphurated Iron Pyrite is wont to insinuate itself sometimes, but, besides being only here and there, the Pyrites are small in size, and few in quantity. It is the same with the Malachite, of which traces only are now and then discoverable. Gold is likewise rare, relatively to what is contained in the 1st variety of Quartz of this species (the 2nd).

We may then say that Iron and Gold, in the forms indicated, are the metals which constitute this third division, which I have studied in various veins and particularly in those where shafts have been opened under the name of "San Antonio" and "San Cristobal" in Cuñapirú, in which, from the surface down to six metres deep in the latter and to fifteen in the former, neither increase nor decrease in the metals has been noted.

This association of metals exists, not only in the veins referred to, but in some others in the district of Yaguari.

CHAPTER XII.

PRODUCTS (YIELD).

The maximum, minimum and average of the Gold extracted from the three metallic divisions give approximately the result as stated below.

But it must be first of all stated that the use of the word "superior" in the classification of these Ores is applied to Quartz, which, as in the specimens marked No. 4, contain the largest quantity of Gold, and hence corresponds to a higher category than that generally classified as first class, and which only yields an average of six ounces of Gold per ton.

Results obtained from the metallic divisions.

Ore of	superior class,	per ton of quartz,	150	ounces of Gold.
,,	1st ,,	,,	6	,,
,,	2nd ,,	,,	2	,,
,,	3rd ,,	,,	¼	,,

Theaverage yield of these Ores, worked *cuncti promiscui*, is about three ounces of Gold per ton of Quartz.

Minerals of the fourth class, *astiales* (envelopments), do not all contain Gold, and in those which do it is in the proportion of the Quartz of the third class, more or less.*

2nd Division.

Hitherto only summary assays have been made, and so it is from these, as also upon the inferior quantity of Gold which the physical character of this Second Variety of Quartz denotes, that I judge that the yield will be somewhat less than that of the first division, although a larger quantity of Silver may be got from it, on account of the Galena it contains.

3rd Division.

This Ore yields an average of one and a quarter ounces of Gold per ton of Quartz. The experiments carried out with it have been few in number, and we must likewise remark that, in view of the extremely defective method employed for the working of the Ores in this region, it is impossible to have full confidence in the results obtained, and as these results are those set forth in the table on the preceding page, their correctness necessarily corresponds with the far too primitive and rudimentary processes on which they are based.

These results should therefore not be taken as absolutely exact, as this country is without perfect laboratories, nor has it at its disposal any conscientious, analytical chemists—we cannot place reliance on the analysis hitherto effected of the various substances—for they themselves reveal their error, by presenting in their analysis strictly exact as to quantities and qualities of each of components, which very seldom occurs with the most renowned chemists who labour in more advanced countries and provided with complete laboratories.

CHAPTER XIII.

DATA AND REMARKS UPON THE AURIFEROUS REGION OF TACUAREMBÓ.

Gold, in the emergent extremity of some veins is found in larger quantities than at a depth of 4 metres, but it is to be noted that from 4 metres to 15 in depth, it neither diminishes nor increases; the quantity is in general invariable. Several mining works in this region exemplify this fact, as among others in the mines of Minas-Geraes (Brazil) and California, where the veins to a depth of about 170 metres, which I have examined, do not differ as regards the quantity of Gold.

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* The yield of Gold in the rocks mentioned is solely in Veins of Quartz of extraordinary richness. Generally the superior classes of Quartz or "Flower" 1, 2, 3, yield ¼ to 2 ounces of Gold per ton.

It is necessary, moreover, to notice that notwithstanding the title of "auriferous" bestowed on the regions alluded to in the present report, it is not only Gold, in association with the other metals referred to, that is present therein, but also other metallic Ores which in themselves constitute suitable cradles, acting as a matrix for the eruptive Quartz structured in veins and lodes. These metals are *Carbonate of Copper, Lead, Argentiferous Galena, Silver,* particularly the species *Argiroide* and *Freislebenite, Cinnabar* and *Iron* (in the form of oxidized magnetic iron, ologist iron, red hematite and sulphurated pyrite). The regions of California, Matto-Grosso, and Tacuarembó contain all these minerals; the others only some of them, such as copper, lead, argentiferous galena, and iron, but besides those before indicated there exist also in the region of Tacuarembó, *Auriferous and Argentiferous Tellurium* in the district of Yaguari, for which the quartz serves as a matrix. This latter is also present here on the same gangue (quartz), in the department of Maldonado.

HISTORY.

The discovery of Gold in this region of Tacuarembó dates from about the year 1824, when a miner from the Province of Minas-Geraes in Brazil, in the service of a land owner of the region, found in a ravine in this district of Cuñapirú, a few grains of gold; this led some of the inhabitants at once to search for the metal in the land and rocks at the surface, in the sands, streams, and ravines, and it was discovered in the quartz, contained in some vein or other, by Don Federico Nin Reyes in the year 1852, and this gentleman entered into contracts with certain people to establish mining operations in the said region, the ownership of which was conceded to him by the Government of the Nation.

Thus, then, they obtained some small quantities, of which some of them made presents, others kept it and employed it in making rings and other jewellery of small value.

After this first find of Gold in the region of Tacuarembó, other discoveries were made by the shepherds who now and then examined the lands, etc., rather led thereto by the flattering idea of displaying Gold from their own country, than by the desire to acquire greater wealth than what they obtained from the herds they tended.

Such were the results obtained in this region up to the year 1866, in which the first *Geological Surveys* were made, and which attracted the attention not only of the inhabitants of the locality, but also that of strangers, who came in succession, though slowly, to undertake workings, which they carried out in over sixty veins of Auriferous Quartz, some miles distant from each other, and by which they got down to a depth of from 2 to 18 metres; at the same time others took to washing the sands and earths, and made excavations of from 1 to 4 metres deep.

But these people (there were four men), from the year 1824, without any notion whatever how such works should be carried out, were only able to execute them by dint of perseverance and tenacity, urged on by the presence of Gold in the Quartz they extracted, but with no other result than piling it up, after having profited by the richest portion, which they crushed by hand in iron mortars, which made the affair a ruinous one owing to the want of crushing machines.*

Yet nothing prevented certain intruders from notifying to the authorities as many mines as there were shafts, even though a depth of but 2 metres were attained; leaving some of them to open workings in others upon fresh veins of Quartz showing Gold at the surface, and in this spending on these what had been made on the others. Nevertheless, attention was necessarily attracted abroad to the said operations, although carried out without rhyme or reason, for it is a fact that, from that time, several arrobas of Gold from this region, although in small fractional quantities, were sold in the cities of Monte Video and Buenos Aires, and also in the towns of Brazil bordering on this Republic.

These works have also served to give fixed names to certain veins of auriferous Quartz worthy of special mention on account of their richness, such as the mines known as San Pablo, San Gregorio, and San Rafael, which might not have been so clearly designated in this Geological Report if these works had not been carried out.

However, it is very rare to find any person retaining the ownership of a single one of the more or less numerous so called mines he registered. But it may truly be said that a machine for crushing the Quartz in the region would not only have procured them the Capital for carrying on the works, but some would have reaped a rich reward, for they had it ready to hand in the Ore itself.

From the greater part of the workings carried out upon the veins happy results have been obtained, and this is the reason why, although without capital, a few people retain their ownership, working by hand in iron mortars the richest Ore they extract, and the workings are still carried on.

In conclusion, only rudimentary workings have been made in this region, to which the name of "mine" has been wrongly given, and the auriferous and other veins may be considered as in a virgin state, since the workings mentioned are only deserving of the name of explorations of the ground to a greater or less depth.

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* At the beginning of the year 1866, after certain geological explorations undertaken in the preceding year in the Department of Salto, and also in the districts of Cuñapirú, Corrales, Yaguari, Caraguatá, and Cerros Blancos in the Department of Tacuarembó, and after discovering in the Orographic Axis, and in their branches and sub-branches (the Cordilleras del Haedo, Santa Ana, and branches proceeding therefrom, called the mountains of Cuñapirú, Corrales, Yaguari, Caraguatá, etc., etc.), veins of Quartz of igneous origin, and in a great number of them *Quartz containing Gold*, we returned to Cuñapirú with 300 workmen, and carried out mining explorations in all the districts above mentioned, which we continued for years, and although with a smaller number of men we continue them to the present time on our property of the whole Auriferous region, which we call Tacuarembó.

CHAPTER XIV.

Auriferous Alluvial Terraces.

In this region are to be found Alluvial Terraces of modern origin, composed of pebbles, gravel and grit; materials deposited by the waters in the depressions of the land and on the margin of rivers, and of the River Tacuarembó. There are also deltas in some confluents, but they are of very small extent and depth, as is proved by the principal one among them, formed at the confluence of the rivers *Cuñapirú* and *Corrales,* which does not appear to be more than thirty metres in thickness, or in extent more than fifteen square kilometres.

There exist other terraces, in certain points inferior, on the banks of the rivers and of the Tacuarembó, but whether their extent be small or great, it is a fact that, in all their workings undertaken, if only to the depth of four metres, grains of Gold have been got in various sizes, varying from that of a small nut down to a powder as fine as gunpowder (specimen No. 7).

On the margins of the " Rio Cuñapirú, and in one of its affluents, viz: the river *Juan Ventura,* there exist some mounds of earth, resting on banks of *ferruginous clay-slates with* Gold encrusted *on them* (specimens marked No. 8), and the form in which this Gold presents itself is in laminæ and grains (specimen marked No. 9). The mounds also contain Gold in grains and nuggets of various sizes, but what deserves special reference is the one called the "*Plain of Gárim,*" which comprises an area of about twelve kilometres square, although the depth may not exceed twenty-five or thirty metres.

CHAPTER XV.

Diluvial Formation, 150 Square Kilometres in extent.

At the south-west of the confluence of the rivers Corrales and Cuñapirú, and to the west of the river Tacuarembó, exist some alluvial deposits which are not contemporaneous with the terraces previously described.

Encased, and upon the base of the soil, which is coherent siliceous-ferruginous and aluminous, there are found rocks, stones, large and small pebbles and sand, which proceed from the same locality and neighbourhood, wherein the orography is represented by truncated hills broken here and there, forming open valleys intersected by ditches and rivulets, etc., which valleys owe their existence to the almost continuous denudation caused by the action of the waters.

Moreover, there are plateaux, mounds and hills, with flat tops and sides like cornices, formed by basaltic rocks, without striæ or gloss, so that in this small zone there seems to be represented the diluvium of the table-lands.

This formation does not present any great thickness, as is shown in the bed of the river Tacuarembó, and in some of its affluents, where the materials of the *cenozoic* and *carboniferous-lignite* lands adjoin one another, but without intercalation form the basis for those of the diluvium.

In the ravines of the river Tacuarembó, and also in the most marked of some of its affluents, there appears at the surface of the soil a kind of *Loam*, distinct from that of *Pampero*, from which it differs by its predominance in Silica, and the red yellow Oxides of Iron. It has also more cohesion, and is completely free from the calcareous concretions which are infallibly present in the "*Pampero*."

Gold in this *Loam* shows itself in similar forms to those in the Alluvial Terraces, that is, in grains of various sizes, although it appears to be present in larger quantity.

CHAPTER XVI.

CARBONIFEROUS-LIGNITE LAND.

The Carboniferous Land shows itself to the north and east of the district of Yaguari, and to the west of Cuñapirú, into which it penetrates as far as the "*Tres Cerros de Cuñapirú*;" and thence trending W.S.W., it appears to extend to a distance of twenty-seven kilometres towards the village of San Fructuoso.

The class is *Lignite*, although in some points it must be converted into Anthracite, judging by certain specimens which we have examined proceeding from this zone. Since, moreover, and although in the Clayey Slates I recognised fossil impressions of "*Annularia-longifolia*," of "*Pecopteris lonchitica*" and of "*Helechos*" in the slatey-clays, which are inflammable, owing to the carbon substances they contain, yet I could not discover coal, either at the surface of the soil or in the beds of the streams.

A Carboniferous Zone, which comprises about 2,400 square kilometres in area, and which we have studied for years, is situate to the east of this Republic. It extends towards the N.N.W., more or less interrupted by longitudinal orographic hills, varying in latitude from one to nine kilometres, approximately. It runs into the Department of Tacuarembó, where—on this side—the end of its strata undoubtedly is, and its limits form the Auriferous Region, on which we have reported, though summarily, in the present Geological Report.

CLEMENTE BARRIAL POSADA.

MONTEVIDEO, 12TH MARCH, 1878.